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Takeda

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(45) **Date of Patent: Aug. 23, 2016**

(54) **INFORMATION PROCESSING DEVICE, CONTROL METHOD FOR INFORMATION PROCESSING DEVICE, PROGRAM, AND INFORMATION STORAGE MEDIUM FOR DETERMINING COLLISION BETWEEN OBJECTS ON A DISPLAY SCREEN**

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G06F 3/0486 (2013.01)
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CPC ***G06F 3/0486*** (2013.01); ***G06F 3/048*** (2013.01); ***G06F 3/04845*** (2013.01); ***G06F 3/04883*** (2013.01); ***G06F 9/4443*** (2013.01); ***G06F 21/36*** (2013.01); *G06F 2203/04808* (2013.01)

(58) **Field of Classification Search**
None
See application file for complete search history.

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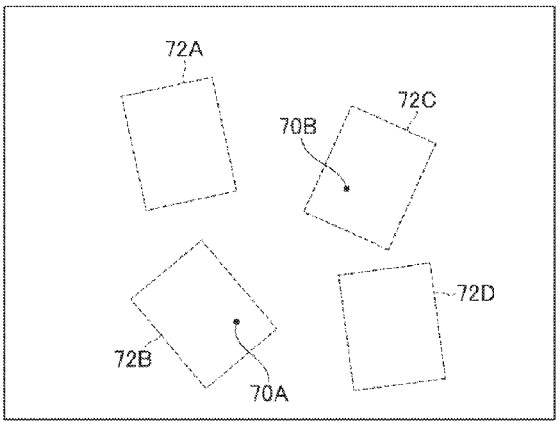
(57) **ABSTRACT**

To provide an information processing device capable of ensuring not to execute processing not intended by a user in a case of stopping the ongoing operation after selecting an object (for example, in selecting again an object other than the object already selected, or the like). In a case where one of a user's designated position is included in a determination area based on the position of one of the plurality of objects displayed in a screen, an object moving unit (**56**) moves the one object based on the one designated position. In a case where the object moving unit (**56**) moves first and second objects, a collision determination unit (**58**) determines whether or not the first and second objects have collided. A processing executing unit (**60**) executes processing relevant to the first and second objects based on a result of determination by the collision determination unit (**58**).

17 Claims, 10 Drawing Sheets



(51) **Int. Cl.**

G06F 9/44	(2006.01)
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G06F 21/36	(2013.01)
G06F 3/0488	(2013.01)

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FIG. 1

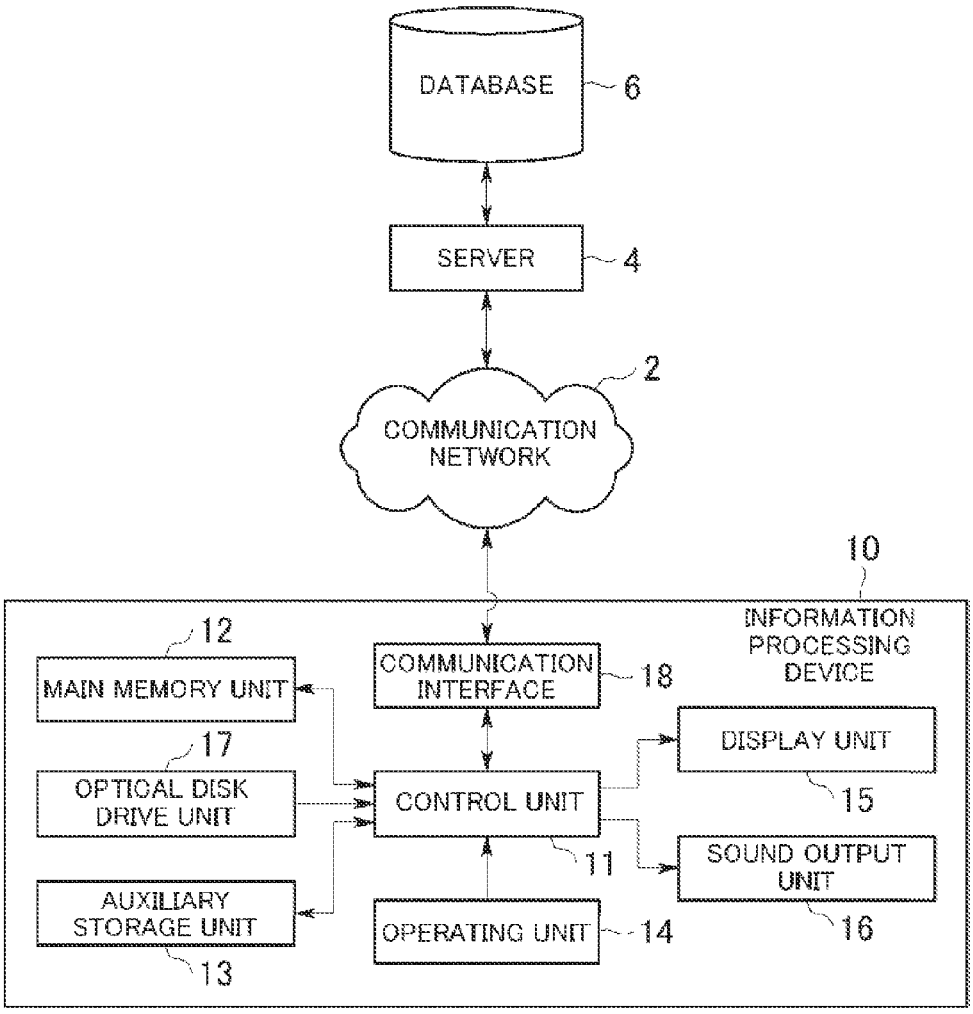

DATABASE
6
SERVER
4
2
COMMUNICATION NETWORK
10
INFORMATION PROCESSING DEVICE
12
MAIN MEMORY UNIT
COMMUNICATION INTERFACE
18
17
OPTICAL DISK DRIVE UNIT
CONTROL UNIT
DISPLAY UNIT
15
11
SOUND OUTPUT UNIT
AUXILIARY STORAGE UNIT
OPERATING UNIT
14
16
13

FIG.2

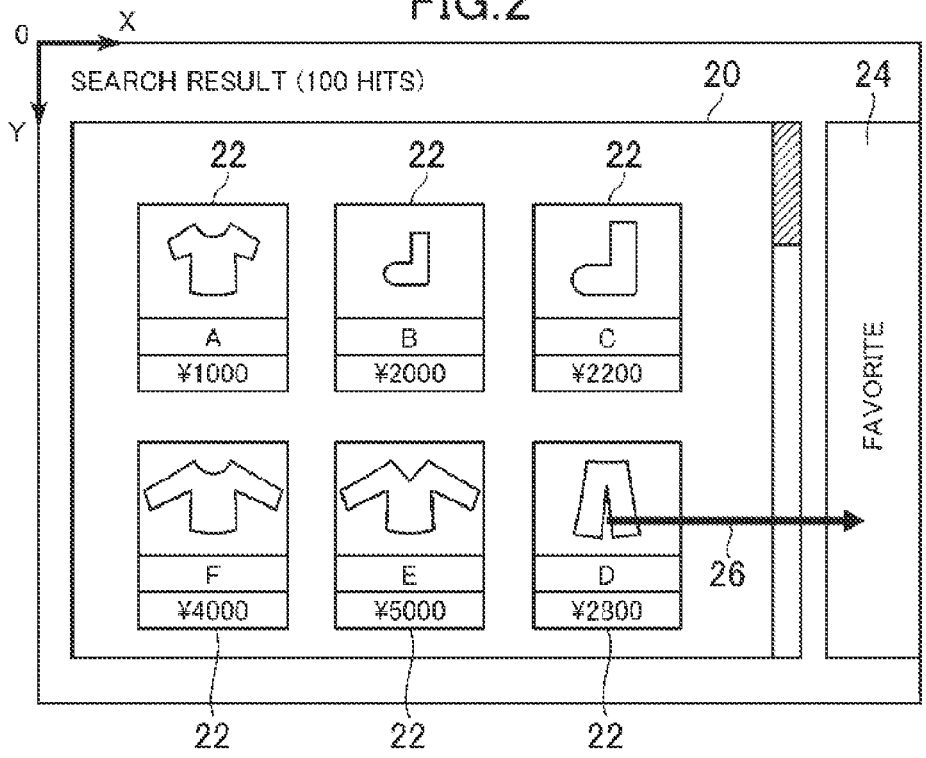
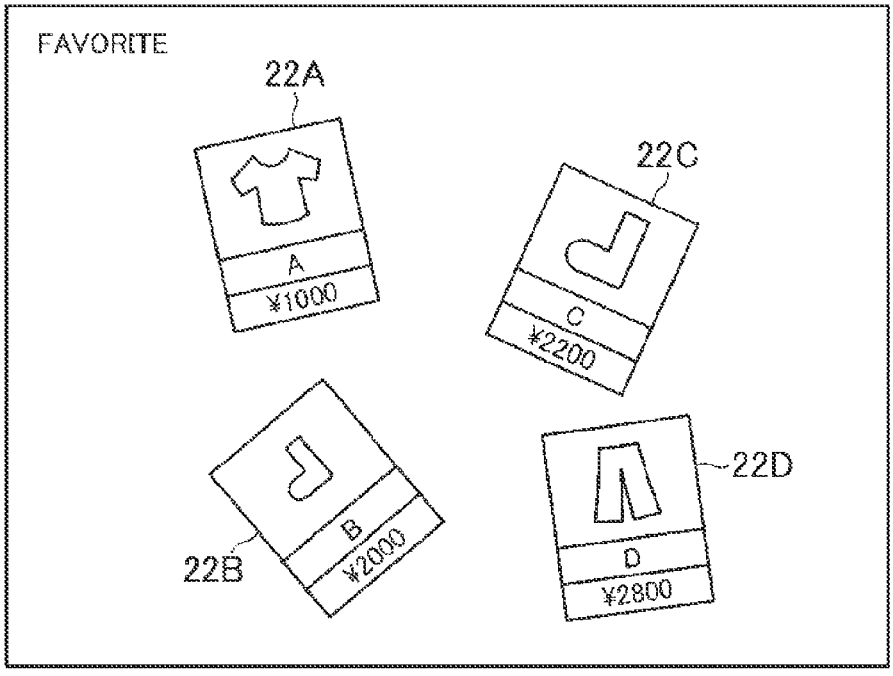

0
X
Y
SEARCH RESULT (100 HITS)
20
24
22
22
22
A
¥1000
B
¥2000
C
¥2200
F
¥4000
E
¥5000
D
¥2800
26
FAVORITE
22
22
22

FIG.3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22C
C
¥2200
22B
B
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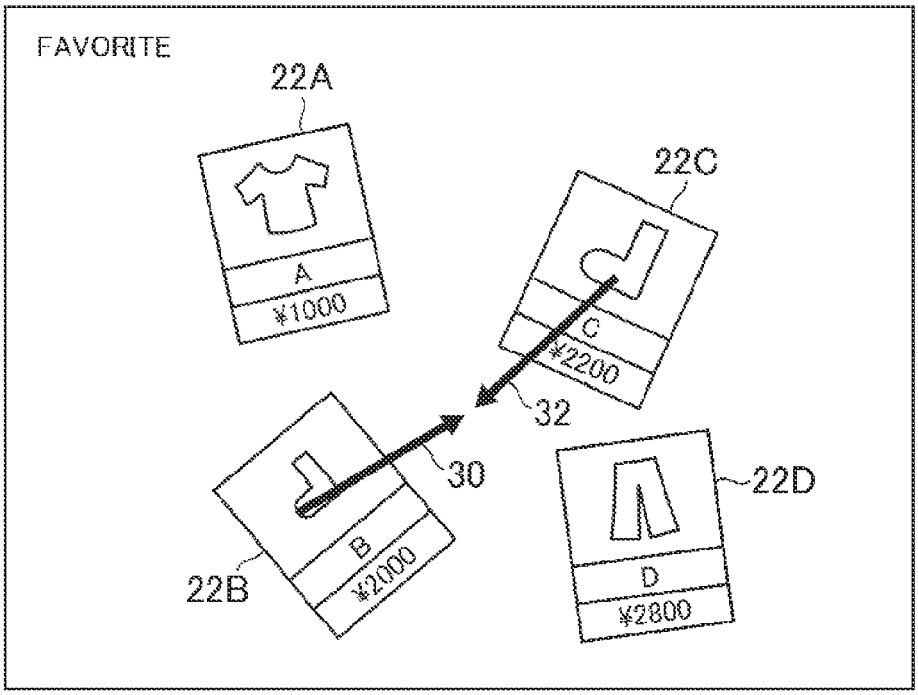
22D
D
¥2800

FIG.4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22C
C
¥2200
32
30
22B
B
¥2000
22D
D
¥2800

FIG.5

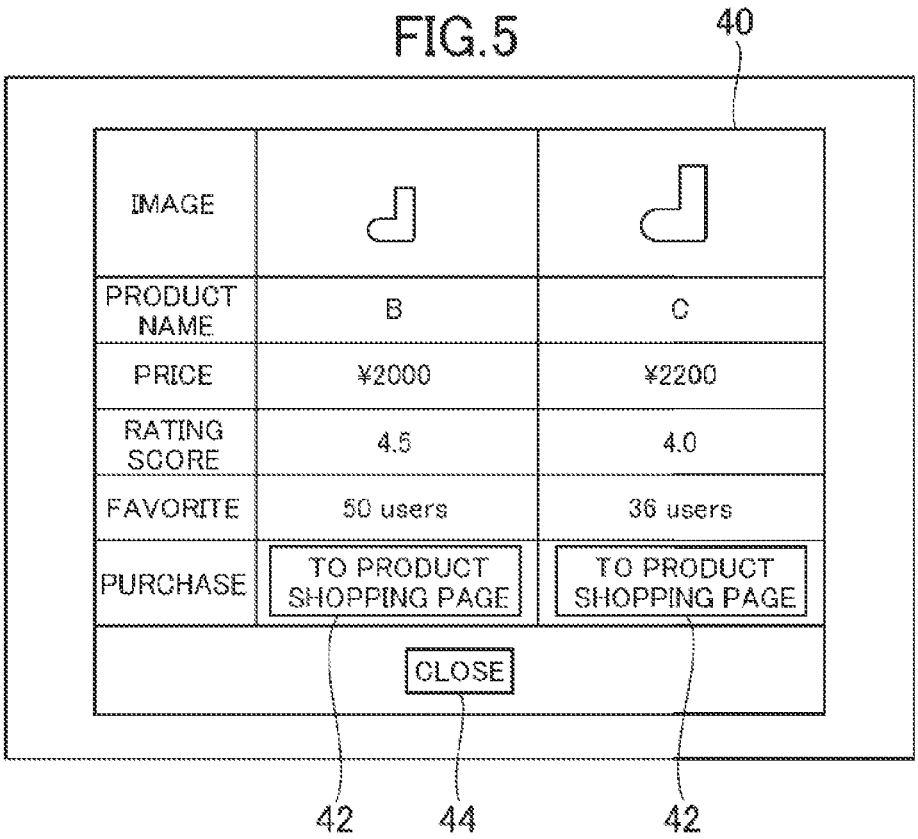
40
IMAGE
PRODUCT NAME
B
C
PRICE
¥2000
¥2200
RATING SCORE
4.5
4.0
FAVORITE
50 users
36 users
PURCHASE
TO PRODUCT SHOPPING PAGE
TO PRODUCT SHOPPING PAGE
CLOSE
42
44
42

FIG.6

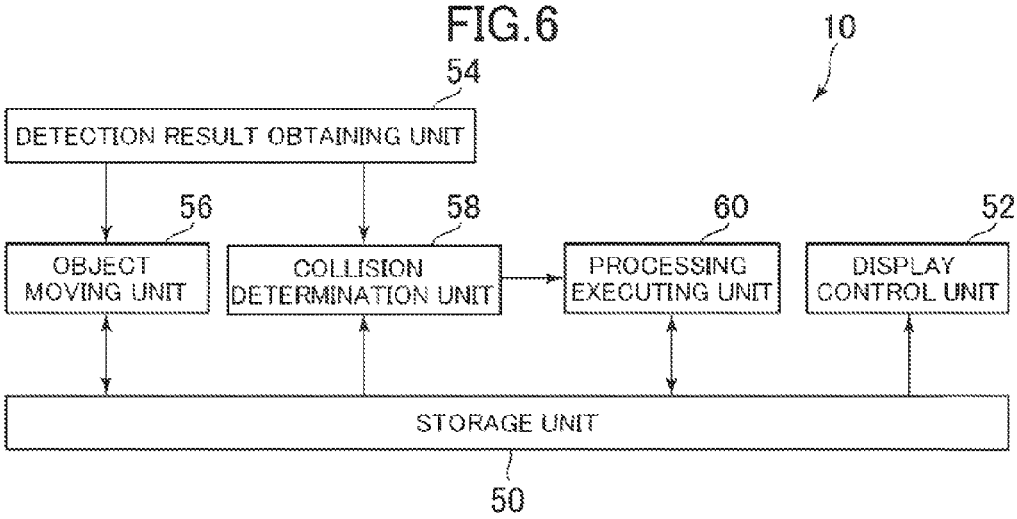

FIG.7

PRODUCT ID	PRODUCT NAME	PRICE	RATING SCORE	REGISTRANTS TO FAVORITE	IMAGE	SHOPPING PAGE
G0100	A	1000	3.0	10	— — —	— — —
G0110	B	2000	4.5	50	— — —	— — —
G0120	C	2200	4.0	36	— — —	— — —
G0130	D	2800	4.8	80	— — —	— — —

FIG.8

OBJECT ID	PRODUCT ID	POSITION
001	G0100	(xa, ya)
002	G0110	(xb, yb)
003	G0120	(xc, yc)
004	G0130	(xd, yd)

FIG.9

	DESIGNATED POSITION
1	(x1, y1)
2	(x2, y2)

FIG.10

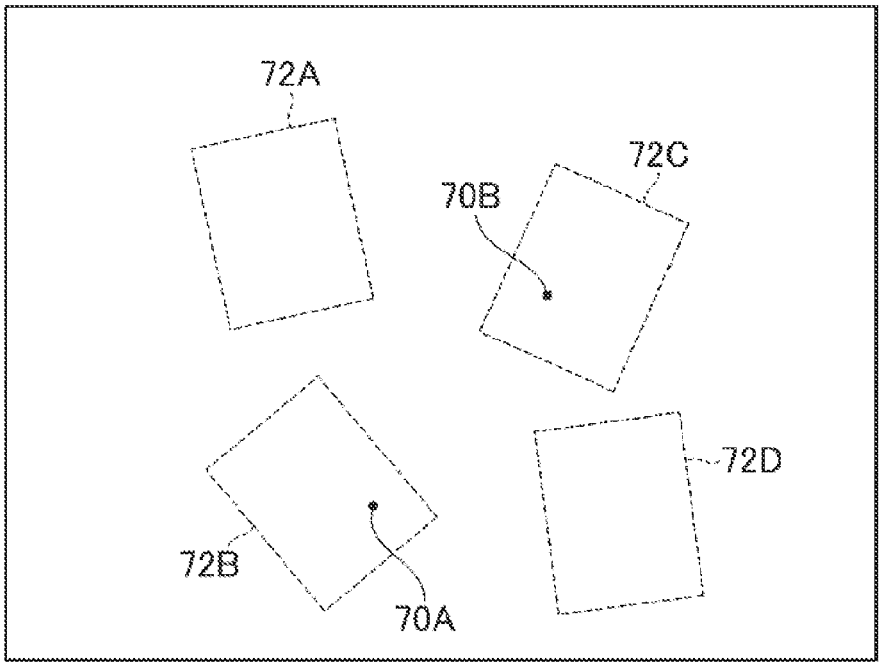

FIG.11

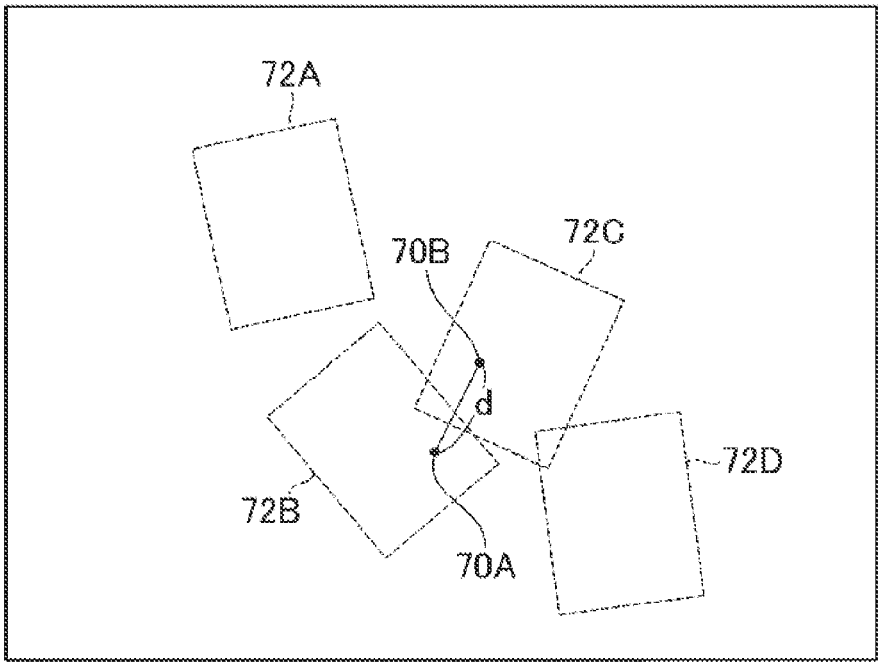

FIG.12

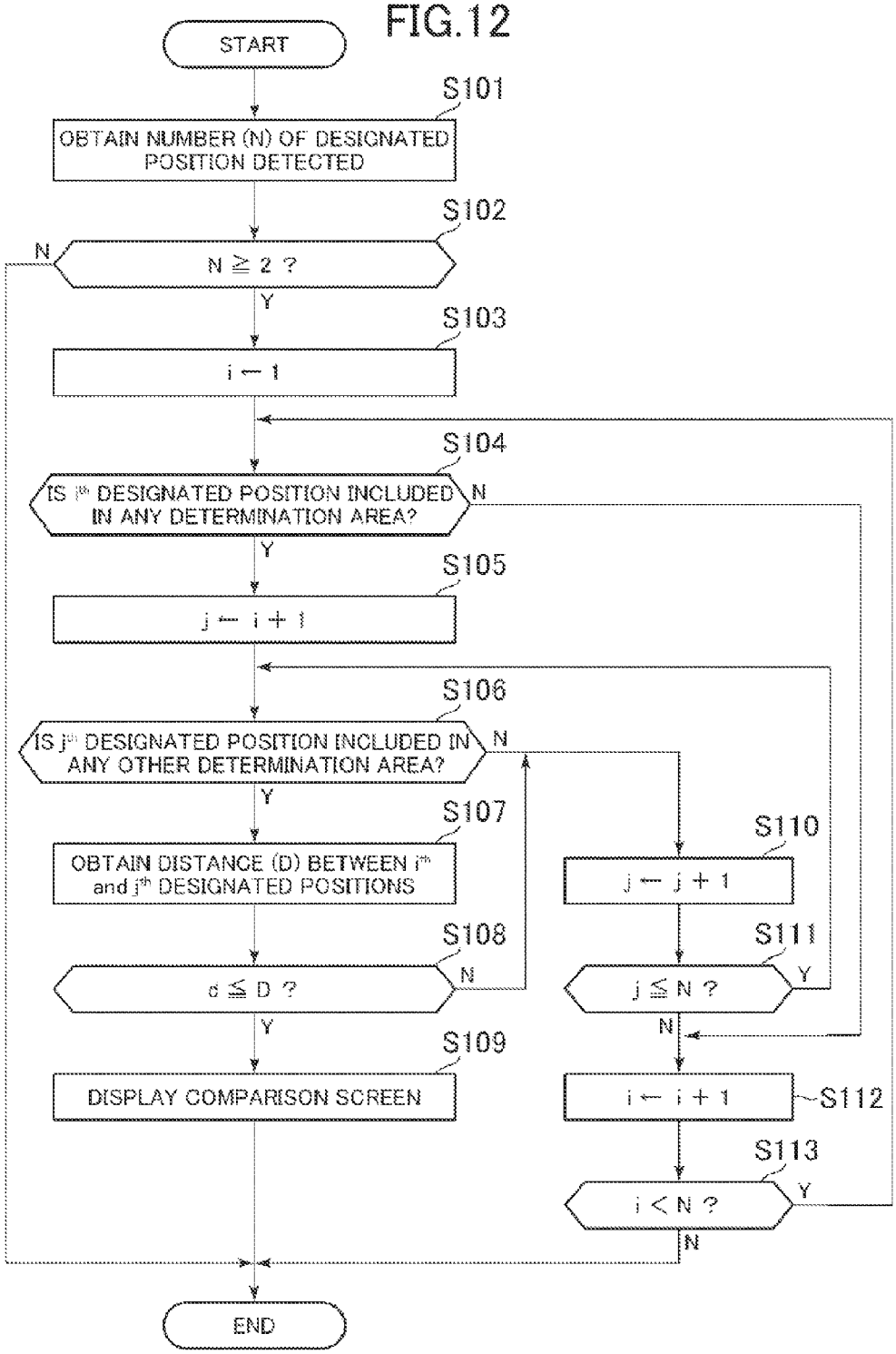
START
S101
OBTAIN NUMBER (N) OF DESIGNATED POSITION DETECTED
S102
N ≧ 2 ?
N
Y
S103
i ← 1
S104
IS i^th DESIGNATED POSITION INCLUDED IN ANY DETERMINATION AREA?
N
Y
S105
j ← i + 1
S106
IS j^th DESIGNATED POSITION INCLUDED IN ANY OTHER DETERMINATION AREA?
N
Y
S107
OBTAIN DISTANCE (D) BETWEEN i^th and j^th DESIGNATED POSITIONS
S108
d ≦ D ?
N
Y
S109
DISPLAY COMPARISON SCREEN
S110
j ← j + 1
S111
j ≦ N ?
Y
N
S112
i ← i + 1
S113
i < N ?
Y
N
END

FIG.13

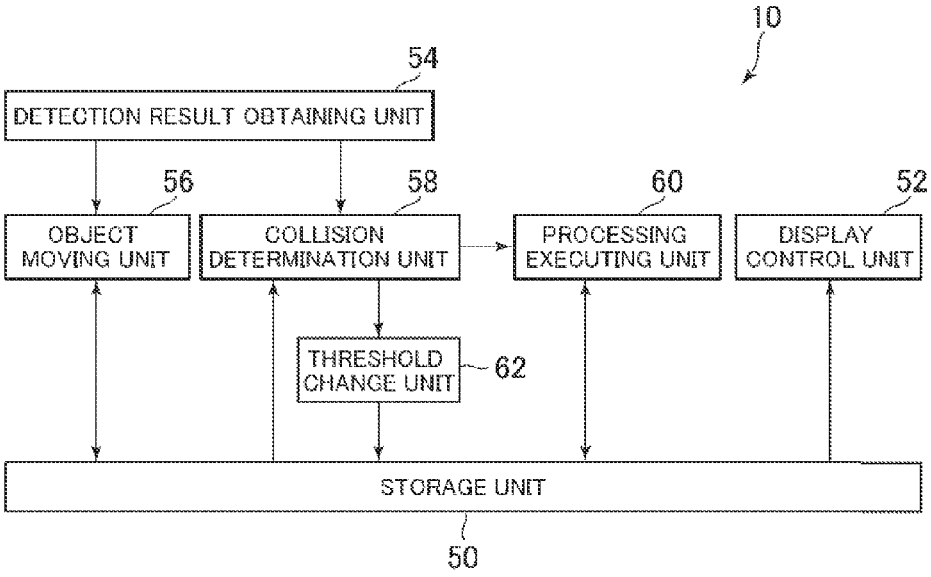

FIG.14

d1
d2
d3
d4
...

FIG.15

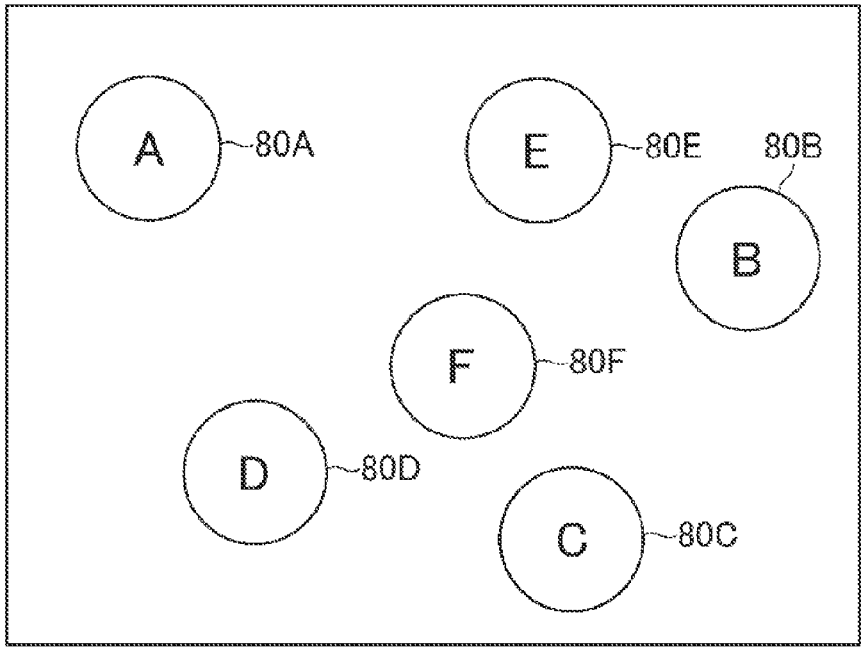

FIG.16

REFERENCE COMBINATION INFORMATION	C, F
REFERENCE DIRECTION INFORMATION	$\vec{V}$

FIG. 17

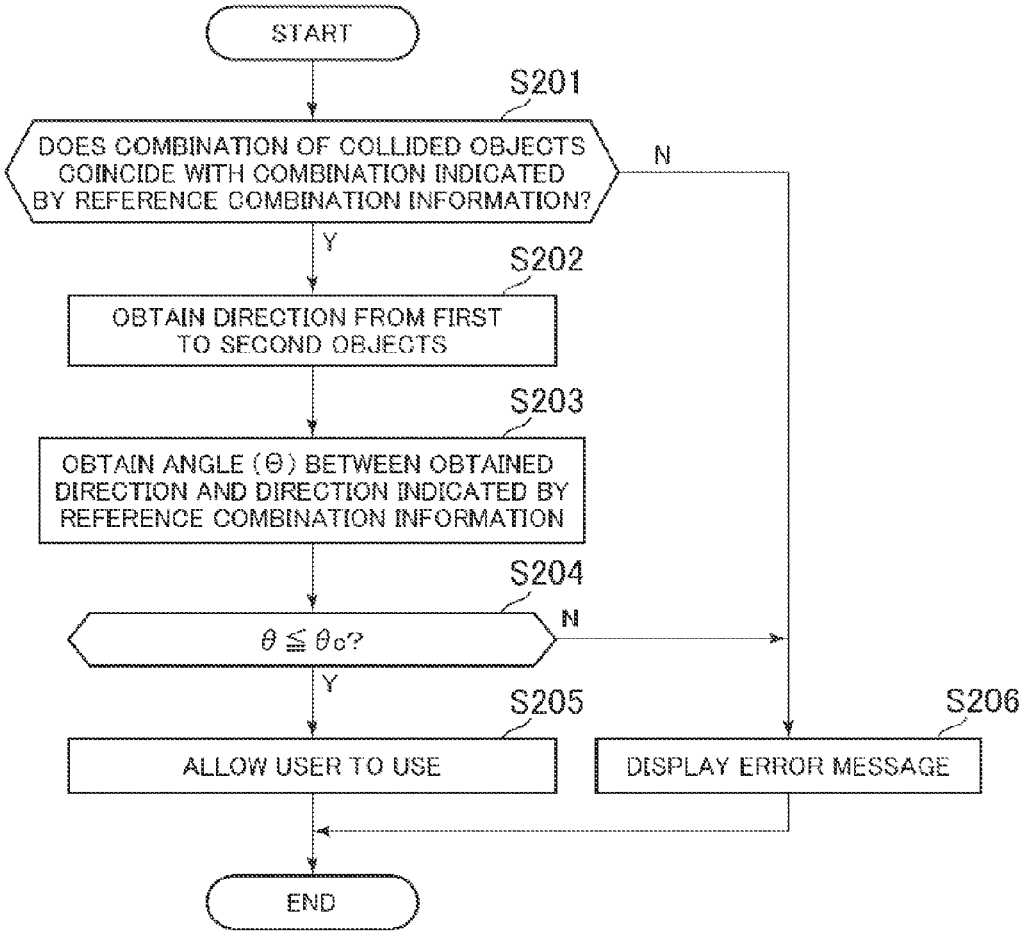
START
S201
DOES COMBINATION OF COLLIDED OBJECTS COINCIDE WITH COMBINATION INDICATED BY REFERENCE COMBINATION INFORMATION?
N
Y
S202
OBTAIN DIRECTION FROM FIRST TO SECOND OBJECTS
S203
OBTAIN ANGLE (Θ) BETWEEN OBTAINED DIRECTION AND DIRECTION INDICATED BY REFERENCE COMBINATION INFORMATION
S204
θ ≦ θc?
N
Y
S205
ALLOW USER TO USE
S206
DISPLAY ERROR MESSAGE
END

FIG.18

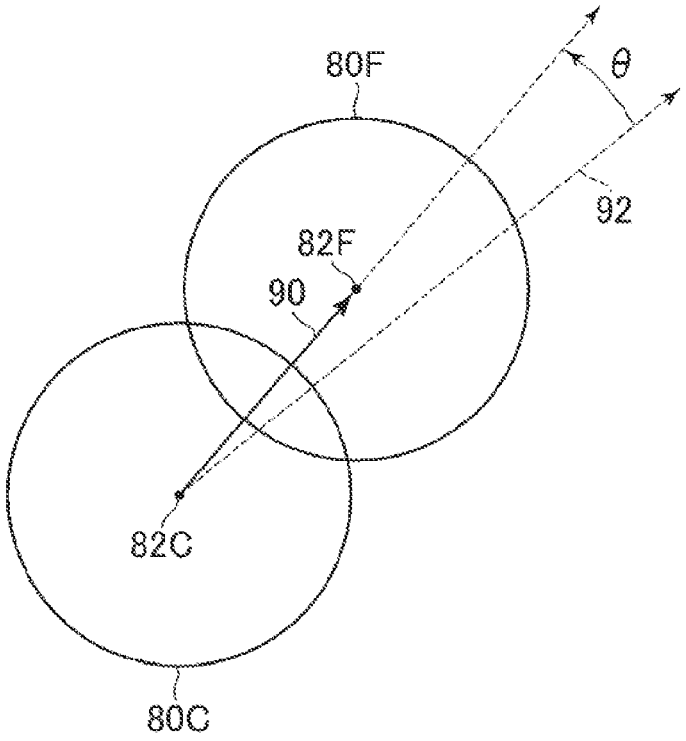

FIG.19

REFERENCE COMBINATION INFORMATION	C, F
REFERENCE RELATIVE SPEED INFORMATION	v

INFORMATION PROCESSING DEVICE, CONTROL METHOD FOR INFORMATION PROCESSING DEVICE, PROGRAM, AND INFORMATION STORAGE MEDIUM FOR DETERMINING COLLISION BETWEEN OBJECTS ON A DISPLAY SCREEN

CROSS REFERENCE TO RELATED APPLICATIONS

This application is a National Stage of International Application No. PCT/JP2012/066806 filed Jun. 29, 2012, claiming priority based on Japanese Patent Application No. 2011-190120 filed Aug. 31, 2011, the contents of all of which are incorporated herein by reference in their entirety.

TECHNICAL FIELD

The present invention relates to an information processing device, a control method for an information processing device, a program, and an information storage medium.

BACKGROUND ART

There has been known an information processing device for displaying a screen including a plurality of objects and executing processing relevant to two objects selected by a user from among the plurality of objects. For such an information processing device, conventionally, a drag and drop operation with respect to an object has been known as an operation for selecting two objects from among the plurality of objects and instructing execution of processing relevant to the two objects. A drag and drop operation is sequential operations of grabbing (selecting) an object, moving the object to another object (drag operation), and releasing the grabbed object (drop operation). When a grabbed object is moved onto another object and then released, processing relevant to these objects is executed.

For example, in a conventional information processing device, when a user performs a drag operation to thereby move an icon representative of a file to an icon representative of a folder and then performs a drop operation, the file is moved or copied to the folder. In addition, for example, Patent Document 1 discloses that when a user performs a drag operation to thereby move a first object onto a second object and then performs a drop operation, replacement processing is executed to replace the second object by the first object. Patent Document 1 additionally discloses a technique for readily determining a target object position where to drop an object.

CITATION LIST

Patent Literature

Patent Literature 1: JP 2006-099733 A

SUMMARY OF INVENTION

Technical Problem

However, according to a conventional drag and drop operation, there may be a case in which processing not intended by a user is executed when stopping the ongoing operation after having grabbed an object (for example, in grabbing an object other than the grabbed object, or the like). Specifically, when the drag operation is stopped halfway in moving an object onto a desired object (that is, the grabbed object is released halfway in moving onto a desired object), and the object is then positioned on another object, processing relevant to those objects may be executed. In order to prevent the above described processing not intended by a user from being executed, the user needs to move the object to a position free from any other objects before stopping the drag operation.

The present invention has been conceived in view of the above, and an object thereof is to provide an information processing device, a control method for an information processing device, a program, and an information storage medium capable of preventing processing not intended by a user from being executed when stopping the ongoing operation after selecting an object (for example, in selecting an object other than an object having been selected).

Solution to Problem

In order to achieve the above described object, an information processing device according to the present invention includes display control means for displaying a screen including a plurality of objects on display means; detection result obtaining means for obtaining a result of detection by detection means capable of detecting a plurality of a user's designated positions in the screen; object moving means for, in a case where one of the user's designated positions is detected by the detection means and the one designated position is included in a determination area that is set based on a position of one object among the plurality of objects, moving the one object in accordance with movement of the one designated position; collision determination means for, in a case where at least one of a first object and a second object is moved by the object moving means, determining whether or not the first object and the second object collide with each other in a state that the user's first designated position is included in a determination area set based on a position of the first object and the user's second designated position is included in a determination area set based on a position of the second object; and processing executing means for executing processing relevant to the first object and the second object based on a result of determination by the collision determination means.

A control method for an information processing device according to the present invention includes a display control step of displaying a screen including a plurality of objects on display means; a detection result obtaining step of obtaining a result of detection by detection means capable of detecting a plurality of a user's designated positions in the screen; an object moving step of, in a case where one of the user's designated positions is detected by the detection means and the one designated position is included in a determination area that is set based on a position of one object among the plurality of objects, moving the one object in accordance with movement of the one designated position; a collision determination step of, in a case where at least one of a first object and a second object is moved at the object moving step, determining whether or not the first object and the second object collide with each other in a state that the user's first designated position is included in a determination area set based on a position of the first object and the user's second designated position is included in a determination area set based on a position of the second object; and a processing executing step of executing processing relevant to the first object and the second object based on a result of determination at the collision determination step.

A program according to the present invention is a program for causing a computer to function as display control means for displaying a screen including a plurality of objects on display means; detection result obtaining means for obtaining a result of detection by detection means capable of detecting a plurality of a user's designated positions in the screen; object moving means for, in a case where one of the user's designated positions is detected by the detection means and the one designated position is included in a determination area that is set based on a position of one object among the plurality of objects, moving the one object in accordance with movement of the one designated position; collision determination means for, in a case where at least one of a first object and a second object is moved by the object moving means, determining whether or not the first object and the second object collide with each other in a state that the user's first designated position is included in a determination area set based on a position of the first object and the user's second designated position is included in a determination area set based on a position of the second object; and a processing executing means for executing processing relevant to the first object and the second object based on a result of determination by the collision determination means.

A computer readable information storage medium according to the present invention is a computer readable information storage medium storing a program for causing a computer to function as display control means for displaying a screen including a plurality of objects on display means; detection result obtaining means for obtaining a result of detection by detection means capable of detecting a plurality of a user's designated positions in the screen; object moving means for, in a case where one of the user's designated positions is detected by the detection means and the one designated position is included in a determination area that is set based on a position of one object among the plurality of objects, moving the one object in accordance with movement of the one designated position; collision determination means for, in a case where at least one of a first object and a second object is moved by the object moving means, determining whether or not the first object and the second object collide with each other in a state that the user's first designated position is included in a determination area set based on a position of the first object and the user's second designated position is included in a determination area set based on a position of the second object; and a processing executing means for executing processing relevant to the first object and the second object based on a result of determination by the collision determination means.

In an embodiment of the present invention, in a case where the user's first designated position is included in the determination area set based on the position of the first object, the user's second designated position is included in the determination area set based on the position of the second object, the at least one of the first object and the second object is moved by the object moving means, and the distance between the first designated position and the second designated position is equal to or smaller than a threshold, the collision determination means may determine the first object and the second object collide with each other.

In an embodiment of the present invention, in a case where the first object and the second object are moved by the object moving means, and a state in which the distance between the first designated position and the second designated position is equal to or smaller than the threshold lasts for a predetermined period of time, the collision determination means may determine the first object and the second object collide with each other.

In an embodiment of the present invention, the information processing device may further include threshold changing means for decreasing the threshold based on a distance between the first designated position and the second designated position, the distance being determined in a past by the collision determination means as being equal to or smaller than the threshold.

In an embodiment of the present invention, in a case where it is determined that the first object and the second object collide with each other, the processing executing means may execute the processing relevant to the first object and the second object based on a collision manner of the first object and the second object.

In an embodiment of the present invention, in the case where it is determined that the first object and the second object collide with each other, the processing executing means may select any of a plurality of kinds of processing relevant to the first object and the second object based on the collision manner of the first object and the second object, and then may execute the selected processing.

In an embodiment of the present invention, the information processing device may further include reference information storage means for storing reference combination information indicating a combination of two objects among the plurality of objects designated in advance by the user, and reference manner information indicating a manner designated in advance by the user as the collision manner of the two objects, the display control means may display the plurality of objects in mutually different display manners in the screen, the processing executing means may include combination determination means for determining whether or not a combination of the first object and the second object is identical to the combination indicated by the reference combination information in the case where it is determined that the first object and the second object collide with each other, collision manner comparing means for comparing a collision manner of the first object and the second object and the manner indicated by the reference manner information in the case where it is determined that the first object and the second object collide with each other, and authentication processing executing means for executing authentication processing based on a result of determination by the combination determination means and a result of comparison by the collision manner comparing means.

In an embodiment of the present invention, the reference manner information may include reference direction information indicating a direction designated in advance by the user, the collision manner comparing means may include direction determination means for determining whether or not an angle between a direction from one to another of the first object or the first designated position and the second object or the second designated position and the direction indicated by the reference direction information is equal to or smaller than a reference angle, and the authentication processing executing means may execute the authentication processing based on the result of determination by the combination determination means and a result of determination by the direction determination means.

In an embodiment of the present invention, the reference manner information may include reference relative speed information indicating a relative speed designated in advance by the user, the collision manner comparing means may include a relative speed determination means for determining whether or not a speed difference between a relative speed of one relative to another of the first object or the first

designated position and the second object or the second designated position and the relative speed indicated by the reference relative speed information is equal to or smaller than a reference difference, and the authentication processing executing means may execute the authentication processing based on the result of determination by the combination determination means and a result of determination by the relative speed determination means.

An information processing device according to the present invention includes display control means for displaying a screen including a plurality of objects on display means; detection result obtaining means for obtaining a result of detection by detection means capable of detecting a plurality of a user's designated positions in the screen; object moving means for, in a case where one of the user's designated positions is detected by the detection means and the one designated position is included in a determination area that is set based on a position of one object among the plurality of objects, moving the one object in accordance with movement of the one designated position; collision determination means for, in a case where at least one of a first object and a second object is moved by the object moving means, determining whether or not the first object and the second object collide with each other; and processing executing means for executing processing relevant to the first object and the second object based on a result of determination by the collision determination means, the processing executing means may include means for obtaining attribute information correlated to the first object and attribute information correlated to the second object stored in attribute information storage means for storing attribute information correlated to each of the plurality of objects, in a case where it is determined that the first object and the second object collide with each other, and means for displaying on the display means a comparison screen for comparing the attribute information correlated to the first object and the attribute information correlated to the second object.

A control method for an information processing device according to the present invention includes a display control step of displaying a screen including a plurality of objects on display means; a detection result obtaining step of obtaining a result of detection by detection means capable of detecting a plurality of a user's designated positions in the screen; an object moving step of, in a case where one of the user's designated positions is detected by the detection means and the one designated position is included in a determination area that is set based on a position of one object among the plurality of objects, moving the one object in accordance with movement of the one designated position; a collision determination step of, in a case where at least one of a first object and a second object is moved at the object moving step, determining whether or not the first object and the second object collide with each other; and a processing executing step of executing processing relevant to the first object and the second object based on a result of determination at the collision determination step, the processing executing step includes a step of obtaining attribute information correlated to the first object and attribute information correlated to the second object stored in attribute information storage means for storing attribute information correlated to each of the plurality of objects, in a case where it is determined that the first object and the second object collide with each other, and a step of displaying on the display means a comparison screen for comparing the attribute information correlated to the first object and the attribute information correlated to the second object.

A program according to the present invention is a program for causing a computer to function as display control means for displaying a screen including a plurality of objects on display means; detection result obtaining means for obtaining a result of detection by detection means capable of detecting a plurality of a user's designated positions in the screen; object moving means for, in a case where one of the user's designated positions is detected by the detection means and the one designated position is included in a determination area that is set based on a position of one object among the plurality of objects, moving the one object in accordance with movement of the one designated position; collision determination means for, in a case where at least one of a first object and a second object is moved by the object moving means, determining whether or not the first object and the second object collide with each other; and processing executing means for executing processing relevant to the first object and the second object based on a result of determination by the collision determination means, the processing executing means includes means for obtaining attribute information correlated to the first object and attribute information correlated to the second object stored in attribute information storage means for storing attribute information correlated to each of the plurality of objects, in a case where it is determined that the first object and the second object collide with each other, and means for displaying on the display means a comparison screen for comparing the attribute information correlated to the first object and the attribute information correlated to the second object.

A computer readable information storage medium according to the present invention is a computer readable information storage medium storing a program for causing a computer to function as display control means for displaying a screen including a plurality of objects on display means; detection result obtaining means for obtaining a result of detection by detection means capable of detecting a plurality of a user's designated positions in the screen; object moving means for, in a case where one of the user's designated positions is detected by the detection means and the one designated position is included in a determination area that is set based on a position of one object among the plurality of objects, moving the one object in accordance with movement of the one designated position; collision determination means for, in a case where at least one of a first object and a second object is moved by the object moving means, determining whether or not the first object and the second object collide with each other; and processing executing means for executing processing relevant to the first object and the second object based on a result of determination by the collision determination means, the processing executing means includes means for obtaining attribute information correlated to the first object and attribute information correlated to the second object stored in attribute information storage means for storing attribute information correlated to each of the plurality of objects, in a case where it is determined that the first object and the second object collide with each other, and means for displaying on the display means a comparison screen for comparing the attribute information correlated to the first object and the attribute information correlated to the second object.

An information processing device according to the present invention includes display control means for displaying a screen including a plurality of objects on display means; detection result obtaining means for obtaining a result of detection by detection means capable of detecting a plurality of a user's designated positions in the screen; object moving

means for, in a case where one of the user's designated positions is detected by the detection means and the one designated position is included in a determination area that is set based on a position of one object among the plurality of objects, moving the one object in accordance with movement of the one designated position; collision determination means for, in a case where at least one of a first object and a second object is moved by the object moving means, determining whether or not the first object and the second object collide with each other; processing executing means for executing processing relevant to the first object and the second object based on a result of determination by the collision determination means; and reference information storage means for storing reference combination information indicating a combination of two objects among the plurality of objects designated in advance by the user, and reference manner information indicating a manner designated in advance by the user as the collision manner of the two objects, the display control means displays the plurality of objects in mutually different display manners in the screen, the processing executing means includes combination determination means for determining whether or not a combination of the first object and the second object is identical to the combination indicated by the reference combination information in a case where it is determined that the first object and the second object collide with each other, collision manner comparing means for comparing a collision manner of the first object and the second object and the manner indicated by the reference manner information in a case where it is determined that the first object and the second object collide with each other, and an authentication processing executing means for executing authentication processing based on a result of determination by the combination determination means and a result of comparison by the collision manner comparing means, the reference manner information includes reference direction information indicating a direction designated in advance by the user, the collision manner comparing means includes a direction determination means for determining whether or not an angle between a direction from one to another of the first object and the second object and the direction indicated by the reference direction information is equal to or smaller than a reference angle, and the authentication processing executing means executes the authentication processing based on the result of determination by the combination determination means and a result of determination by the direction determination means.

A control method for an information processing device according to the present invention includes a display control step of displaying a screen including a plurality of objects on display means; a detection result obtaining step of obtaining a result of detection by detection means capable of detecting a plurality of a user's designated positions in the screen; object moving step of, in a case where one of the user's designated positions is detected by the detection means and the one designated position is included in a determination area that is set based on a position of one object among the plurality of objects, moving the one object in accordance with movement of the one designated position; a collision determination step of, in a case where at least one of a first object and a second object is moved at the object moving step, determining whether or not the first object and the second object collide with each other; a processing executing step of executing processing relevant to the first object and the second object based on a result of determination at the collision determination step; and a step of obtaining at least a part of content stored in reference information storage means for storing reference combination information indicating a combination of two objects among the plurality of objects designated in advance by the user, and reference manner information indicating a manner designated in advance by the user as the collision manner of the two objects, wherein at the display control step, the plurality of objects are displayed in mutually different display manners in the screen, the processing executing step includes a combination determination step of determining whether or not a combination of the first object and the second object is identical to the combination indicated by the reference combination information in a case where it is determined that the first object and the second object collide with each other, a collision manner comparing step of comparing a collision manner of the first object and the second object and the manner indicated by the reference manner information in a case where it is determined that the first object and the second object collide with each other, and an authentication processing executing step of executing authentication processing based on a result of determination at the combination determination step and a result of comparison at the collision manner comparing step, the reference manner information includes reference direction information indicating a direction designated in advance by the user, the collision manner comparing step includes a direction determination step of determining whether or not an angle between a direction from one to another of the first object and the second object and the direction indicated by the reference direction information is equal to or smaller than a reference angle, and at the authentication processing executing step, the authentication processing is executed based on the result of determination at the combination determination step and a result of determination at the direction determination step.

A program according to the present invention is a program for causing a computer to function as display control means for displaying a screen including a plurality of objects on display means; detection result obtaining means for obtaining a result of detection by detection means capable of detecting a plurality of a user's designated positions in the screen; object moving means for, in a case where one of the user's designated positions is detected by the detection means and the one designated position is included in a determination area that is set based on a position of one object among the plurality of objects, moving the one object in accordance with movement of the one designated position; collision determination means for, in a case where at least one of a first object and a second object is moved by the object moving means, determining whether or not the first object and the second object collide with each other; processing executing means for executing processing relevant to the first object and the second object based on a result of determination by the collision determination means; and means for obtaining at least a part of content stored in a reference information storage means for storing reference combination information indicating a combination of two objects among the plurality of objects designated in advance by the user, and reference manner information indicating a manner designated in advance by the user as the collision manner of the two objects, wherein the display control means displays the plurality of objects in mutually different display manners in the screen, the processing executing means includes combination determination means for determining whether or not a combination of the first object and the second object is identical to the combination indicated by the reference combination information in a case where it is determined that the first object and the second

object collide with each other, collision manner comparing means for comparing a collision manner of the first object and the second object and the manner indicated by the reference manner information in a case where it is determined that the first object and the second object collide with each other, and authentication processing executing means for executing authentication processing based on a result of determination by the combination determination means and a result of comparison by the collision manner comparing means, the reference manner information includes reference direction information indicating a direction designated in advance by the user, the collision manner comparing means includes direction determination means for determining whether or not an angle between a direction from one to another of the first object and the second object and the direction indicated by the reference direction information is equal to or smaller than a reference angle, and the authentication processing executing means executes the authentication processing based on the result of determination by the combination determination means and a result of determination by the direction determination means.

A computer readable information storage medium according to the present invention is a computer readable information storage medium storing a program for causing a computer to function as display control means for displaying a screen including a plurality of objects on display means; detection result obtaining means for obtaining a result of detection by detection means capable of detecting a plurality of a user's designated positions in the screen; object moving means for, in a case where one of the user's designated positions is detected by the detection means and the one designated position is included in a determination area that is set based on a position of one object among the plurality of objects, moving the one object in accordance with movement of the one designated position; collision determination means for, in a case where at least one of a first object and a second object is moved by the object moving means, determining whether or not the first object and the second object collide with each other; processing executing means for executing processing relevant to the first object and the second object based on a result of determination by the collision determination means; and means for obtaining at least a part of content stored in reference information storage means for storing reference combination information indicating a combination of two objects among the plurality of objects designated in advance by the user, and reference manner information indicating a manner designated in advance by the user as the collision manner of the two objects, wherein the display control means displays the plurality of objects in mutually different display manners in the screen, the processing executing means includes combination determination means for determining whether or not a combination of the first object and the second object is identical to the combination indicated by the reference combination information in a case where it is determined that the first object and the second object collide with each other, collision manner comparing means for comparing a collision manner of the first object and the second object and the manner indicated by the reference manner information in the case where it is determined that the first object and the second object collide with each other, and authentication processing executing means for executing authentication processing based on a result of determination by the combination determination means and a result of comparison by the collision manner comparing means, the reference manner information includes reference direction information indicating a direction designated in advance by the user, the collision manner comparing means includes direction determination means for determining whether or not an angle between a direction from one to another of the first object and the second object and the direction indicated by the reference direction information is equal to or smaller than a reference angle, and the authentication processing executing means executes the authentication processing based on the result of determination by the combination determination means and a result of determination by the direction determination means.

An information processing device according to the present invention includes display control means for displaying a screen including a plurality of objects on display means; detection result obtaining means for obtaining a result of detection by detection means capable of detecting a plurality of a user's designated positions in the screen; object moving means for, in a case where one of the user's designated positions is detected by the detection means and the one designated position is included in a determination area that is set based on a position of one object among the plurality of objects, moving the one object in accordance with movement of the one designated position; collision determination means for, in a case where at least one of a first object and a second object is moved by the object moving means, determining whether or not the first object and the second object collide with each other; processing executing means for executing processing relevant to the first object and the second object based on a result of determination by the collision determination means; and reference information storage means for storing reference combination information indicating a combination of two objects among the plurality of objects designated in advance by the user, and reference manner information indicating a manner designated in advance by the user as the collision manner of the two objects, wherein the display control means displays the plurality of objects in mutually different display manners in the screen, the processing executing means includes combination determination means for determining whether or not a combination of the first object and the second object is identical to the combination indicated by the reference combination information in a case where it is determined that the first object and the second object collide with each other, collision manner comparing means for comparing a collision manner of the first object and the second object and the manner indicated by the reference manner information in the case where it is determined that the first object and the second object collide with each other, and authentication processing executing means for executing authentication processing based on a result of determination by the combination determination means and a result of comparison by the collision manner comparing means, the reference manner information includes reference relative speed information indicating a relative speed designated in advance by the user, the collision manner comparing means includes relative speed determination means for determining whether or not a speed difference between a relative speed of one of the first object and the second object relative to another of the first object and the second object and the relative speed indicated by the reference relative speed information is equal to or smaller than a reference difference, and the authentication processing executing means executes the authentication processing based on the result of determination by the combination determination means and a result of determination by the relative speed determination means.

A control method for an information processing device according to the present invention includes a display control step of displaying a screen including a plurality of objects on

display means; a detection result obtaining step of obtaining a result of detection by detection means capable of detecting a plurality of a user's designated positions in the screen; an object moving step of, in a case where one of the user's designated positions is detected by the detection means and the one designated position is included in a determination area that is set based on a position of one object among the plurality of objects, moving the one object in accordance with movement of the one designated position; a collision determination step of, in a case where at least one of a first object and a second object is moved at the object moving step, determining whether or not the first object and the second object collide with each other; and a processing executing step of executing processing relevant to the first object and the second object based on a result of determination at the collision determination step; and a step of obtaining at least a part of content stored in reference information storage means for storing reference combination information indicating a combination of two objects among the plurality of objects designated in advance by the user, and reference manner information indicating a manner designated in advance by the user as the collision manner of the two objects, wherein at the display control step, the plurality of objects are displayed in mutually different display manners in the screen, the processing executing step includes a combination determination step of determining whether or not a combination of the first object and the second object is identical to the combination indicated by the reference combination information in a case where it is determined that the first object and the second object collide with each other, a collision manner comparing step of comparing a collision manner of the first object and the second object and the manner indicated by the reference manner information in the case where it is determined that the first object and the second object collide with each other, and an authentication processing executing step of executing authentication processing based on a result of determination at the combination determination step and a result of comparison at the collision manner comparing step, the reference manner information includes reference relative speed information indicating a relative speed designated in advance by the user, the collision manner comparing step includes a relative speed determining step for determining whether or not a speed difference between a relative speed of one of the first object and the second object relative to another of the first object and the second object and the relative speed indicated by the reference relative speed information is equal to or smaller than a reference difference in the case where it is determined that the first object and the second object collide with each other, and at the authentication processing executing step, the authentication processing is executed based on the result of determination at the combination determination step and a result of determination at the relative speed determination step.

A program according to the present invention is a program for causing a computer to function as display control means for displaying a screen including a plurality of objects on display means; detection result obtaining means for obtaining a result of detection by detection means capable of detecting a plurality of a user's designated positions in the screen; object moving means for, in a case where one of the user's designated positions is detected by the detection means and the one designated position is included in a determination area that is set based on a position of one object among the plurality of objects, moving the one object in accordance with movement of the one designated position; collision determination means for, in a case where at least one of a first object and a second object is moved by the object moving means, determining whether or not the first object and the second object collide with each other; processing executing means for executing processing relevant to the first object and the second object based on a result of determination by the collision determination means; and means for obtaining at least a part of content stored in reference information storage means for storing reference combination information indicating a combination of two objects among the plurality of objects designated in advance by the user, and reference manner information indicating a manner designated in advance by the user as the collision manner of the two objects, wherein the display control means displays the plurality of objects in mutually different display manners in the screen, the processing executing means includes combination determination means for determining whether or not a combination of the first object and the second object is identical to the combination indicated by the reference combination information in a case where it is determined that the first object and the second object collide with each other, collision manner comparing means for comparing a collision manner of the first object and the second object and the manner indicated by the reference manner information in the case where it is determined that the first object and the second object collide with each other, and authentication processing executing means for executing authentication processing based on a result of determination by the combination determination means and a result of comparison by the collision manner comparing means, the reference manner information includes reference relative speed information indicating a relative speed designated in advance by the user, the collision manner comparing means includes a relative speed determination means for determining whether or not a speed difference between a relative speed of one of the first object and the second object relative to another of the first object and the second object and the relative speed indicated by the reference relative speed information is equal to or smaller than a reference difference in the case where it is determined that the first object and the second object collide with each other, and the authentication processing executing means executes the authentication processing based on the result of determination by the combination determination means and a result of determination by the relative speed determination means.

A computer readable information storage medium according to the present invention is a computer readable information storage medium storing a program for causing a computer to function as display control means for displaying a screen including a plurality of objects on display means; detection result obtaining means for obtaining a result of detection by detection means capable of detecting a plurality of a user's designated positions in the screen; object moving means for, in a case where one of the user's designated positions is detected by the detection means and the one designated position is included in a determination area that is set based on a position of one object among the plurality of objects, moving the one object in accordance with movement of the one designated position; collision determination means for, in a case where at least one of a first object and a second object is moved by the object moving means, determining whether or not the first object and the second object collide with each other; processing executing means for executing processing relevant to the first object and the second object based on a result of determination by the collision determination means; and means for obtaining at least a part of content stored in reference information storage

means for storing reference combination information indicating a combination of two objects among the plurality of objects designated in advance by the user, and reference manner information indicating a manner designated in advance by the user as the collision manner of the two objects, wherein the display control means displays the plurality of objects in mutually different display manners in the screen, the processing executing means includes combination determination means for determining whether or not a combination of the first object and the second object is identical to the combination indicated by the reference combination information in a case where it is determined that the first object and the second object collide with each other, collision manner comparing means for comparing a collision manner of the first object and the second object and the manner indicated by the reference manner information in the case where it is determined that the first object and the second object collide with each other, and authentication processing executing means for executing authentication processing based on a result of determination by the combination determination means and a result of comparison by the collision manner comparing means, the reference manner information includes reference relative speed information indicating a relative speed designated in advance by the user, the collision manner comparing means includes a relative speed determination means for determining whether or not a speed difference between a relative speed of one of the first object and the second object relative to another of the first object and the second object and the relative speed indicated by the reference relative speed information is equal to or smaller than a reference difference in the case where it is determined that the first object and the second object collide with each other, and the authentication processing executing means executes the authentication processing based on the result of determination by the combination determination means and a result of determination by the relative speed determination means.

Advantageous Effects of Invention

According to the present invention, it is possible to ensure not to execute processing not intended by a user when stopping the ongoing operation after selecting an object (for example, in selecting an object other than the object already selected, or the like).

BRIEF DESCRIPTION OF DRAWINGS

FIG. **1** shows one example of a hardware structure of an information processing device according to an embodiment of the present invention;

FIG. **2** shows one example of a search result screen;

FIG. **3** shows one example of a favorite screen;

FIG. **4** is a diagram explaining an operation for comparing two products;

FIG. **5** shows one example of a comparison screen;

FIG. **6** is a functional block diagram of the information processing device;

FIG. **7** shows one example of a favorite table;

FIG. **8** shows one example of an object table;

FIG. **9** shows one example of designated position data;

FIG. **10** is a diagram explaining a determination area;

FIG. **11** is a diagram explaining a collision determining method;

FIG. **12** is a flowchart of an example of processing executed in the information processing device;

FIG. **13** is a functional block diagram of the information processing device;

FIG. **14** shows one example of history data;

FIG. **15** shows one example of an authentication screen;

FIG. **16** shows one example of reference combination information and reference direction information;

FIG. **17** is a flowchart of one example of processing executed in the information processing device;

FIG. **18** is a diagram explaining processing executed in the information processing device; and

FIG. **19** shows one example of reference combination information and reference speed information.

DESCRIPTION OF EMBODIMENTS

In the following, examples of embodiments of the present invention will be described in detail with reference to the accompanying drawings.

First Embodiment

Initially, an information processing device according to a first embodiment of the present invention will be described. The information processing device according to the first embodiment is implemented using, for example, a portable phone, a portable information terminal, a personal computer, a game device, or the like. FIG. **1** shows one example of a hardware structure of an information processing device **10** in this embodiment. As shown in FIG. **1**, the information processing device **10** includes a control unit **11**, a main memory unit **12**, an auxiliary storage unit **13**, an operating unit **14**, a display unit **15**, a sound output unit **16**, an optical disk drive unit **17**, and a communication interface **18**.

The control unit **11** includes, for example, one or more CPUs, and executes information processing according to an operation system or a program stored in the auxiliary storage unit **13**. The main storage unit **12** is a RAM, for example, while the auxiliary storage unit **13** is a hard disk or a solid state drive, for example.

The operating unit **14** is used for user operation. In this embodiment, a designation unit for use by a user to designate a position in a screen displayed on the display unit **15** is provided as the operating unit. That is, a pointing device, such as, for example, a touch panel, a mouse, a stick, or the like, is provided as the operating unit. Note that the following description is based on an assumption that the information processing device **10** has a touch panel provided on the display unit **15**.

The touch panel provided to the information processing device **10** is a general touch panel, and capable of detecting one or more positions touched by a user. As a touch panel, a touch panel employing a static capacitance method, for example, is used. With the touch panel employing the static capacitance method, one or more positions touched by a user is/are detected, based on change in the charge that is caused upon a user's touching the surface of the touch panel. The touch panel supplies information indicative of one or more positions touched by the user. The control unit **11** obtains the one or more positions touched by the user, based on the information supplied from the touch panel.

The display unit **15** is a liquid crystal display, or the like, for example, and the sound output unit **16** is a speaker or the like, for example. The optical disk drive unit **17** reads a program and/or data stored in an optical disk (an information storage medium).

Note that, for example, a program and data is supplied to the auxiliary storage unit **13** via an optical disk. That is, an

optical disk with a program and data recorded thereon is inserted in the optical disk drive unit **17**, and the program and/or data recorded on the optical disk is read by the optical disk drive unit **17** and then stored in the auxiliary storage unit **13**. Note that the optical disk drive unit **17** is not an essential structural element. A structural element for reading a program or data stored in an information storage medium (for example, a memory card) other than an optical disk may be included, instead of the optical disk drive unit **17**, so that a program and/or data may be supplied to the auxiliary storage unit **13** via an information storage medium other than an optical disk. Alternatively, a program and/or data may be supplied to the auxiliary storage unit **13** via a communication network **2** including, for example, the Internet or the like.

The communication interface **18** is an interface for connecting the information processing device **10** to the communication network **2**. The information processing device **10** can access the server **4** via the communication network **2**.

The server **4** executes processing based on a processing request received from the information processing device **10**. For example, a demon program is activated in the server **4**, and upon receipt of a processing request from the information processing device **10**, the server **4** accesses the database **6**, when necessary, and sends a processing result in response to the processing request to the information processing device **10**. The database **6** may be ensured in a server computer different from the server **4** or in the server **4**.

In the above described information processing device **10**, processing that is relevant to two objects selected by a user from among a plurality of objects displayed in a screen is executed.

In the following, the above described technique will be described, referring to a case as an example in which an electronic commercial site where a user can buy a product via the communication network **2** is provided by the server **4**, and an application program for using the electronic commercial site is executed in the information processing device **10**.

Initially, the above-described application program will be described. FIGS. **2** to **4** show one example of a screen displayed on the display unit **15** of the information processing device **10** when the above-described application program is executed.

FIG. **2** shows one example of a search result screen. The search result screen is a screen showing a list of products that satisfy a search condition set based on an input by a user in a search screen (not shown).

The search result screen is displayed through data exchange between the information processing device **10** (the above-described application program) and the server **4**. That is, the above-described application program sends to the server **4** a search condition that is set based on an input by a user in the search screen. Having received the search condition, the server **4** accesses the database **6** to obtain a list of products satisfying the search condition. Then, the server **4** sends the obtained product list to the information processing device **10**. The search result screen showing the product list sent from the server **4** is displayed in the information processing device **10**.

As shown in FIG. **2**, the search result screen includes a list area **20**. In the list area **20**, a list of products satisfying the search condition is displayed. Specifically, a product image **22** of each product satisfying the search condition is displayed in the list area **20**. The product image **22** includes a thumb nail image of the product, and the name and price of the product are attached to the product image **22**.

The search result screen includes a favorite area **24**. The favorite area **24** is used for registration of a product as a favorite among the products displayed in the list area **20**.

In the following, an operation for registering a product as a favorite will be described. Assume a case in which a user registers a product "D" as a favorite. In this case, the user touches the touch panel with his/her finger so as to point out the product image **22** of the product "D", then slides the finger to the favorite area **24** on the touch panel, as indicated by the arrow **26**. In response to such an operation, the product image **22** of the produce "D" moves to the favorite area **24** in accordance with the movement of the finger, and the product "D" is resultantly registered as a favorite. Upon new registration of a product as a favorite, a favorite screen showing a list of products registered as favorites is displayed.

FIG. **3** shows one example of the favorite screen. In the favorite screen, product images **22** of the products registered as favorites are displayed. FIG. **3** shows one example of the favorite screen with the products "A", "B", "C", and "D" registered as favorite products. In the favorite screen shown in FIG. **3**, the product images **22**A, **22**B, **22**C, and **22**D of the products "A", "B", "C", and "D" are displayed. In the favorite screen, the initial display position and orientation of the product image **22** are determined at random. As a result, the product images **22** are displayed scattered, like the product images **22**A to **22**D shown in FIG. **3**.

This favorite screen as well is displayed through data exchange between the information processing device **10** (the above-described application program) and the server **4**. That is, when the product image **22** of any product moves to the favorite area **24** in the search result screen, the above-described application program sends the product ID of the product, together with the user ID, to the server **4**.

A table showing a product registered by a user as a favorite is stored in the database **6**, and the server **4** updates the table, based on the above-described user ID and product ID received from the information processing device **10**. Further, the server **4** obtains information on a product registered by a user as a favorite from the database **6**, and sends the obtained information to the information processing device **10**. In the information processing device **10**, the information sent from the server **4** is stored in the auxiliary storage unit **13** (see FIG. **7** to be described later), and the favorite screen is displayed based on the information.

In the favorite screen, a user can select and compare two products with each other. In the following, an operation for comparing two products will be described. FIG. **4** is a diagram explaining this operation. Assume a case here in which the products "B" and "C" are compared with each other.

In comparing the products "B" and "C", a user performs, for example, a "pinching operation" to collide the product image **22**B of the produce "B" against the produce image **22**C of the produce "C". That is, the user puts one finger (for example, the thumb) of his/her one hand (for example, the right hand) on the touch panel so as to point out the product image **22**B of the produce "B", and another finger (for example, the index finger) on the touch panel so as to point out the product image **22**C of the produce "C". Thereafter, the user slides these fingers so as to get closer to each other on the touch panel. With such an operation, the product image **22**B of the produce "B" and the product image **22**C

of the produce "C" move getting closer to each other, as indicated by the arrows **30**, **32**, in accordance with the movement of the fingers.

Then, when it is determined that the product image **22**B of the produce "B" has collided against the product image **22**C of the produce "C", a comparison screen for comparing the products "B" and "C" is displayed. FIG. **5** shows one example of the comparison screen in this case. In the comparison screen in this case, a comparison table **40** showing various information on the products "B" and "C" is displayed.

A purchaser of a product can rate the product with the full score of five points, for example, in the electronic commercial site. That is, the average of the ratings registered by purchasers of the product is displayed in the "rating score" section in the comparison table **40**. When a product is registered as a favorite in the above-described search result screen, the server **4** is notified of the fact that the product is registered as a favorite, and the number of users having registered the product as a favorite is stored in the database **6**. The "favorite" section in the table **40** shows the number of users having registered the product as a favorite.

In the comparison screen, a link button **42** for jumping to a shopping screen for buying a respective product is displayed. Selection of the link button **42** causes a shopping screen (not shown) for buying a concerned product to appear. Further, a close button **44** is also displayed in the comparison screen. Selection of the close button **44** causes the comparison screen to close and the favorite screen to appear again.

When a user points out to thereby select two product images **22** from among a plurality of product images **22** displayed in the favorite screen and moves the two fingers to thereby move the two product images **22** so as to collide, a comparison screen for the two products is displayed. That is, according to the information processing device **10**, a user can instruct the information processing device **10** to display a comparison screen for two products through an intuitive operation of colliding two product images **22**.

Note that a drag and drop operation may be employed as an operation for instructing the information processing device **10** to display a comparison screen for two products. That is, it is feasible to display, when a user performs a drag operation to thereby move one product image **22** onto another product image **22** and then a drop operation with the products images **22** placed one on the other, a comparison screen for two products of those product images **22**.

With the above described drag and drop operation employed, however, there may be a case in which, when intending to move, through a drag operation, one product image **22** onto his/her desired product image **22** among a plurality of densely placed product images **22** and then perform a drop operation, a user may perform a drop operation with the one product image **22** erroneously placed on a product image **22** other than his/her desired product image **22**. In such a case, a comparison image for two products not intended by the user is displayed.

On the contrary, according to the information processing device **10** in this embodiment, a user initially selects both of the product images **22** of two products for comparison, and then the user moves the product images **22** so as to collide. Asa result, a comparison screen for the two products is displayed. With the above, the above described inconvenience is unlikely caused. That is, even if a product image **22** other than a desired product image **22** is selected, unless the product image **22** is caused to collide against another product image **22**, a comparison screen for these products is not displayed. In this case, the user simply detaches his/her finger from the touch panel, and selects again a product image **22**. As described above, according to the information processing device **10** in this embodiment, a comparison screen for two products not intended by a user is unlikely displayed.

Further, with the above described drag and drop operation employed, when a user stops the ongoing drag operation halfway in moving one product image **22**, which then happens to be placed on another product image **22**, a comparison screen for these products is displayed. That is, a comparison screen for two products not intended by the user is displayed. To address the above, the user needs to move the one product image **22** to a position not overlapping another product image **22** before stopping the drag operation.

On the contrary, according to the information processing device **10** in the first embodiment, the above described inconvenience is not caused. That is, even when a user detaches his/her finger from the touch panel to select a different product image **22** after selecting a product image **22** other than a desired product image **22**, the user does not need to particularly care whether or not the selected product image **22** happens to be positioned on another product image **22**. This is because a comparison screen for products is not displayed unless the product images **22** selected by the user collide even though the selected product image **22** is placed on another product image **22**.

In the following, a structure for implementing the above described favorite screen (user interface) will be described. FIG. **6** is a functional block diagram showing only a functional block relevant to collision determination processing in the favorite screen among those implemented by the information processing device **10** in this embodiment. As shown in FIG. **6**, the information processing device **10** includes a storage unit **50**, a display control unit **52**, a detection result obtaining unit **54**, an object moving unit **56**, a collision determination unit **58**, and a processing executing unit **60**.

For example, the storage unit **50** is implemented using the main storage unit **12** and the auxiliary storage unit **13**. The display control unit **52**, the detection result obtaining unit **54**, the object moving unit **56**, the collision determination unit **58**, and the processing executing unit **60** are implemented by the control unit **11**. That is, the control unit **11** executes processing according to a program, thereby functioning as these functional blocks.

The storage unit **50** will be described. The storage unit **50** stores various data. FIGS. **7** to **9** show one example of data stored in the storage unit **50**.

FIG. **7** shows one example of a favorite table. The favorite table is a table showing information on a product registered as a favorite. As described above, in displaying the favorite screen, information on a product registered by a user as a favorite is obtained from the server **4** (database **6**). The obtained information is registered in the favorite table.

The favorite table shown in FIG. **7** includes "product ID", "product name", "price", "rating score", "number of registrants to favorite", "image", and "shopping page" fields. In the "product ID" field, identification information (product ID) uniquely identifying a product is registered. In the "product name" and "price" fields, the name and price of a product are respectively registered. In the "rating score" field, the average of the rating scores made by purchasers of the product is registered. In the "number of registrants to favorite" field, the number of users having registered the product as a favorite is registered. In the "image" field, link

information (URL) to a normal image and a thumb nail image of the product is registered. In the "shopping page" field, link information (URL) to a shopping page (shopping screen) for the product is registered.

FIG. **8** shows one example of the object table. The object table is a table for managing an object (product image **22**) displayed in the favorite screen. The object table includes "object ID", "product ID", and "position" fields. In the "object ID" field, identification information (object ID) uniquely identifying an object (product image **22**) is registered. In the "product ID" field, the product ID of a product correlated to an object (product image **22**) is registered. For example, for the product image **22** of the product "A", the product ID of the product "A" is registered in the "product ID" field. In the "position" field, a display position of an object (product image **22**) is registered. For example, the screen coordinates of a representative position (for example, the center position) of an object (product image **22**) is registered. Note that a screen coordinate system is a coordinate system having the origin defined at the upper left corner of a screen, the X axis being positive in the rightward direction, and the Y axis being positive in the downward direction.

In the following, the display control unit **52** will be described. The display control unit **52** displays a screen including a plurality of objects on the display unit **15**. In this embodiment, the display control unit **52** displays a favorite screen on the display unit **15**. That is, in this embodiment, the favorite screen corresponds to the above-described "screen", and a plurality of product images **22** displayed in the favorite screen correspond to the above-described "plurality of objects".

In the following, the detection result obtaining unit **54** will be described. The detection result obtaining unit **54** obtains a result of detection by a detection unit capable of detecting two or more positions designated by a user in a screen. For example, the pointing device corresponds to the "detection unit". In this embodiment, the touch panel corresponds to the "detection unit", and the detection result obtaining unit **54** obtains a position designated by a user (a user's designated position) and detected by the touch panel. For example, when a user designates two positions (a first designated position and a second designated position) in a screen, the touch panel detects the first designated position and the second designated position. Then, the detection result obtaining unit **54** obtains the first designated position and the second designated position detected by the touch panel. In this case, the detection result obtaining unit **54** obtains designated position data, such as is shown in FIG. **9**, for example. Note that a user's designated position is expressed using the coordinates of the screen coordinate system.

In the following, the object moving unit **56** will be described. While one of a user's designated positions is detected by the detection unit, the object moving unit **56** determines whether or not the one designated position is included in a determination area that is set based on the position of one object among the plurality of objects. When the one designated position is included in the determination area set based on the position of one object, the object moving unit **56** moves the one object in accordance with movement of the one designated position.

For example, when a user's first designated position is detected by the detection unit, the object moving unit **56** determines whether or not the first designated position is included in the determination area that is set based on the display position of any object among a plurality of objects. Further, when the user's second designation position is detected by the detection unit, besides the first designated position, the object moving unit **56** determines whether or not the second designated position is included in the determination area that is set based on the display position of another object among the plurality of objects.

Below, the "determination area" will be described. A determination area is an area that is set for determining whether or not a user is pointing out an object. A determination area is set based on the display position of an object, and moves in accordance with movement of the object. For example, an area where an object is displayed is set as a determination area. The determination area may not necessarily coincide with the area where the object is displayed. For example, an area including the entire area where an object is displayed and also being larger than the area where the object is displayed may be set as a determination area. Further, for example, for an object in a relatively complicated shape, a determination area having a relatively simpler shape may be set.

FIG. **10** is a diagram explaining a determination area in a case where the favorite screen, such as is shown in FIG. **3**, is displayed. Note that the reference numeral "**70**A" in FIG. **10** indicates a user's first designated position, and "**70**B" indicates the user's second designated position.

As product images **22**A to **22**D are displayed in the favorite screen shown in FIG. **3**, determination areas **72**A to **72**D are set in the example shown in FIG. **10**. Note that, in the following, the determination areas **72**A to **72**D may be collectively referred to as a "determination area **72**".

The determination area **72**A is a determination area corresponding to the product image **22**A of the product "A", and the area where the product image **22**A is displayed is set as the determination area **72**A. Similarly, the determination area **72**B is a determination area corresponding to the product image **22**B of the produce "B", and the area where the product image **22**B is displayed is set as the determination area **72**B. The determination area **72**C is a determination area corresponding to the product image **22**C of the produce "C", and the area where the product image **22**C is displayed is set as the determination area **72**C. The determination area **72**D is a determination area corresponding to the product image **22**D of the produce "D", and the area where the product image **22**D is displayed is set as the determination area **72**D.

In the example shown in FIG. **10**, for example, the object moving unit **56** determines whether or not the first designated position **70**A is included in any of the determination areas **72**A to **72**D. Further, the object moving unit **56** determines whether or not the second designated position **70**B is included in any of the determination areas **72**A to **72**D.

When the first designated position is included in the first determination area corresponding to the first object, the object moving unit **56** moves the first object in accordance with movement of the first designated position. Further, when the second designated position is included in the second determination area corresponding to the second object, the object moving unit **56** moves the second object in accordance with movement of the second designated position.

In the example shown in FIG. **10**, for example, as the first designated position **70**A is included in the determination area **72**B, the object moving unit **56** moves the product image **22**B in accordance with movement of the first des-

ignated position **70**A. That is, the object moving unit **56** causes the product image **22**B to follow the first designated position **70**A.

In the example shown in FIG. **10**, as the second designated position **70**B is included in the determination area **72**C, the object moving unit **56** moves the product image **22**C in accordance with movement of the second designated position **70**B. That is, the object moving unit **56** causes the product image **22**C to follow the second designated position **70**B.

In the following, the collision determination unit **58** will be described. The collision determination unit **58** determines whether or not a first object has collided against a second object when at least one of the first and second objects has been moved by the object moving unit **56**.

For example, the collision determination unit **58** determines whether or not the first object has collided against the second object by determining whether or not the distance between the first designated position and the second designated position has become equal to or smaller than a threshold. In other words, the collision determination unit **58** determines whether or not the distance between the first designated position and the second designated position has become equal to or smaller than the threshold when the first designated position is included in the first determination area and the second designated position is included in the second determination area, to thereby determine whether or not the first object has collided against the second object. The collision determination unit **58** determines that the first object has collided against the second object when at least one of the first and second objects has been moved by the object moving unit **56** and the distance between the first designated position and the second designated position has become equal to or smaller than the threshold.

In the example shown in FIG. **10**, for example, the first designated position **70**A is included in the determination area **72**B, and the second designated position **70**B is included in the determination area **72**C. In this case, as described above, the object moving unit **56** moves the product image **22**B in accordance with movement of the first designated position **70**A and the product image **22**C in accordance with movement of the second designated position **70**B. In this case, as shown in FIG. **11**, the collision determination unit **58** obtains the distance (d) between the first designated position **70**A and the second designated position **70**B, and determines whether or not the distance (d) has become equal to or smaller than the threshold to thereby determine whether or not the product image **22**B has collided against the product image **22**C.

When it is determined that the above-described distance (d) is equal to or smaller than the threshold, the collision determination unit **58** determines that the product image **22**B has collided against the product image **22**C. In the example shown in FIG. **11**, although the determination area **72**B overlaps the determination area **72**C (that is, the product image **22**B overlaps the product image **22**C), the collision determination unit **58** does not determine the product image **22**B has collided against the product image **22**C unless the above-described distance (d) is equal to or smaller than the threshold.

In the example shown in FIG. **11**, although the determination area **72**C overlaps the determination area **72**D (that is, the product image **22**C overlaps the product image **22**D), the collision determination unit **58** does not determine that the product image **22**B has collided against the product image **22**D as a user's designated position is not included in the determination area **72**D.

In the following, the processing executing unit **60** will be described. The processing executing unit **60** executes processing relevant to the first object and the second object, based on the result of determination by the collision determination unit **58**. For example, when it is determined that the first object has collided against the second object, the processing executing unit **60** displays a comparison screen for comparing attribute information correlated to the first object and attribute information correlated to the second object on the display unit **15**.

For example, in the example shown in FIG. **11**, when it is determined that the distance (d) between the first designated position **70**A and the second designated position **70**B has become equal to or smaller than the threshold (that is, when it is determined that the product image **22**B has collided against the product image **22**C), the processing executing unit **60** executes processing relevant to the product image **22**B and the product image **22**C.

In this case, the processing executing unit **60** displays a comparison screen, such as is shown in FIG. **5**, on the display unit **15**. That is, the processing executing unit **60** displays a comparison screen for comparing information on the product "B" correlated to the product image **22**B and information on the product "C" correlated to the product image **22**C on the display unit **15**.

In the following, processing that is executed by the information processing device **10** while the favorite screen is displayed will be described. FIG. **12** is a flowchart of an example of processing that is repetitively executed for every predetermined period of time (for example, $1/60^{th}$ of a second) in the information processing device **10** while the favorite screen is displayed. Note that processing for moving the product image **22** in accordance with change of a user's designated position is also executed while the favorite screen is displayed, which, however, is not shown in FIG. **12**. FIG. **12** mainly shows processing for determining whether or not the product images **22** have collided. The control unit **11** executes the processing shown in FIG. **12** according to the program, thereby functioning as the detection result obtaining unit **54**, the collision determination unit **58**, and the processing executing unit **60**.

As shown in FIG. **12**, initially, the control unit **11** (detection result obtaining unit **54**) obtains the number (N) of a user's designated positions detected by the detection unit (touch panel) (S**101**). Then, the control unit **11** determines whether or not the obtained number (N) is two or larger (S**102**). When the obtained number (N) is not two or larger, the control unit **11** terminates this processing.

Meanwhile, when the obtained number (N) is two or larger, the control unit **11** initialize the value of the variable i to 1 (S**103**). Then, the control unit **11** determines whether or not the i^{th} designated position is included in any determination area **72** (S**104**). Note that "the i^{th} designated position" refers to the i^{th} designated position among the designated positions detected by the detection unit (touch panel).

When the i^{th} designated position is included in any determination area **72**, the control unit **11** initializes the value of the variable j to i+1 (S**105**), and determines whether or not the j^{th} designated position is included in another determination area **72** (S**106**). Note that "another determination area **72**" refers to a determination area **72** other than the determination area **72** that is determined at step S**104** as including the i^{th} designated position.

When the j^{th} designated position is included in another determination area **72**, the control unit **11** obtains the distance (d) between the i^{th} designated position and the j^{th}

designated position (S107). Then, the control unit **11** (collision determination unit **58**) determines whether or not the distance (d) is equal to or smaller than a threshold (D) (S108). When the distance (d) is equal to or smaller than the threshold (D), the control unit **11** (processing executing unit **60**) determines that the product images **22** have collided, and displays the comparison screen (FIG. **5**) on the display unit **15**. In this case, a comparison screen for the product of the product image **22** corresponding to the determination area that is determined at step S104 as including the i^{th} designated position and the product of the product image **22** corresponding to the determination area **72** that is determined at step S106 as including the i^{th} designated position is displayed. The comparison screen is displayed based on the favorite table shown in FIG. **7**.

Meanwhile, when it is not determined at step S104 that the i^{th} designated position is included in any determination area **72**, the control unit **11** increments the value of the variable i (S112), and then determines whether or not the variable i is smaller than the number (N) of the user's designated positions detected (S113). When it is determined that the variable i is smaller than the number (N) of the user's designated positions detected, the control unit **11** executes the processing at step S104. Meanwhile, when it is not determined that the variable i is smaller than the number (N) of the user's designated positions detected, the control unit **11** terminates this processing.

Further, when it is not determined at step S106 that the j^{th} designated position is included in another determination area **72** or when it is not determined at step S108 that the distance (d) is equal to or smaller than the threshold (D), the control unit **11** increments the value of the variable j (S110), and then determines whether or not the value of the variable j is equal to or smaller than the number (N) of the user's designated positions detected (S111). When it is determined that the variable j is equal to or smaller than the number (N) of the user's designated positions detected, the control unit **11** executes the processing at step S106. Meanwhile, when it is not determined that the variable j is equal to or smaller than the number (N) of the user's designated positions detected, the control unit **11** executes the processing at step S112. Description on the processing shown in FIG. **12** is completed with the above.

According to the information processing device **10** in the above described first embodiment, when a user selects two product images **22** from among a plurality of product images **22** displayed in the favorite screen by pointing out the two product images **22** with his/her two fingers, and moves the two fingers to thereby move the two product images **22** so as to collide, a comparison screen for the two products is displayed. That is, according to the information processing device **10**, a user can instruct the information processing device **10** to display a comparison screen for two produces through an intuitive operation of selecting and colliding two product images **22**.

Note here that, for example, a drag and drop operation may be possibly employed as an operation for displaying a comparison screen for two products. That is, it is feasible to display a comparison screen for the two products when a user performs a drag operation to thereby move one product image **22** onto another product image **22** and then a drop operation with the products images **22** placed one on the other.

With the above described drag and drop operation employed, however, there may be a case in which a user may perform a drop operation with one product image **22** erroneously placed on a product image **22** other than his/her desired product image **22** when intending to move, through a drag operation, the one product image **22** onto his/her desired product image **22** among a plurality of densely placed product images **22** and then perform a drop operation. In such a case, a comparison image for two products not intended by the user is displayed.

Further, with the above described drag and drop operation employed, in a case where a user stops the drag operation halfway after having started moving one product image **22**, if the one product image **22** happens to be placed on another product image **22**, a comparison screen for these products is displayed. To address the above, the user needs to move the one product image **22** to a position not overlapping any other product image **22** before stopping the drag operation.

On the contrary, according to the information processing device **10** in the first embodiment, if a user initially selects both of the product images **22** of two products for comparison and then moves the product images **22** so as to collide, a comparison screen for the two products is displayed. With the above, the above described inconvenience is unlikely caused. That is, even though a product image **22** other than a desired product image **22** is selected, unless the product image **22** is caused to collide against another product image **22**, a comparison screen for these products is not displayed. In this case, the user simply detaches his/her finger from the touch panel, and selects again a product image **22**. As described above, according to the information processing device **10** in this embodiment, a comparison screen for two products not intended by a user is unlikely displayed. Further, according to the information processing device **10** in the first embodiment, the user does not need to particularly care the position of the product image **22** when stopping the ongoing operation halfway as a comparison screen for products is not displayed unless the product images **22** selected by the user collide even though the selected product image **22** is positioned on another product image **22**.

Further, an operation for simply selecting both of the product images **22** of two products for comparison may be applicable as an operation for displaying a comparison screen for the two products. That is, it is feasible that, when a user selects one product image **22** and then another product image **22**, a comparison screen for these products may be displayed. However, with such an operation employed, when a user erroneously selects a product image **22** other than his/her desired product image **22** as a second product image **22**, a comparison screen for two products not intended by the user is displayed. On the contrary, according to the information processing device **10** in the first embodiment, as described above, a comparison screen for two products not intended by a user is unlikely displayed.

Further, as an operation for displaying a comparison screen for two products, an operation described below, for example, may be employed:

(a) click the left button of a mouse while pointing out one product image **22** with the mouse to thereby select the product image **22**;

(b) click the left button of the mouse while pointing out another product image **22** with the mouse to thereby select the product image **22**; and

(c) click thereafter the right button of the mouse to thereby instruct to display a comparison screen for the products of these product images **22**.

The above described operation, however, requires a left button and a right button of a mouse, and thus cannot be employed in an information processing device having no mouse. For example, a tablet-type information processing

device having a touch panel but a mouse cannot employ the above-described operation. On the contrary, an operation employed in the information processing device **10** according to the first embodiment can be employed in an information processing device having no mouse.

According to the information processing device **10** in the first embodiment, it is possible to improve accuracy in determining whether or not a user has collided the product images **22** displayed in the favorite screen.

As a collision determination method for the product images **22**, there may be available a method for determining whether or not the product images **22** contact each other or are placed one on the other to thereby determine whether or not the product images **22** have collided. However, when an screen is small in the size or when a larger number of product images **22** in view of the size of the screen are displayed in the screen, product images **22** likely contact each other or are placed one on the other. Therefore, according to the above-described collision determining method, it is likely to be determined that the product images **22** have collided. As a result, it may be determined that the product images **22** have collided despite lack of a user's intention of colliding the product images **22**, which may be felt stressful by a user.

On the contrary, according to the information processing device **10** in the first embodiment, determination as to whether or not product images **22** have collided is made based on two positions designated by a user. Consequently, according to the information processing device **10** in the first embodiment, it is possible to avoid determining that the product images **22** have collided despite lack of a user's intention of colliding the product images **22**.

Note that the first embodiment can be arranged as described below.

[1] In the example shown in FIG. **11**, for example, when the object moving unit **56** moves the product image **22**B and the product image **22**C, the collision determination unit **58** may determine whether or not "a state in which the distance (d) between the first designated position **70**A and the second designated position **70**B is equal to or smaller than a threshold" lasts for a reference period of time. In other words, the collision determination unit **58** may determine whether or not "a state in which the first designated position **70**A is included in the determination area **72**B, the second designated position **70**B is included in the determination area **72**C, and the distance (d) between the first designated position **70**A and the second designated position **70**B is equal to or smaller than a threshold" lasts for a reference period of time. Then, when the above-described state lasts for the reference period of time, the control unit **11** may determine the product image **22**B has collided against the product image **22**C.

With the above, it is possible to avoid determining that the product image **22**B has collided against the product image **22**C when the above described distance (d) temporarily becomes equal to or smaller than the threshold despite lack of a user's intention of colliding the product image **22**B and the product image **22**C. In this manner, it is possible to further improve accuracy in determining whether or not a user has collided the product images **22** displayed in the favorite screen.

[2] As shown in FIG. **13**, for example, the information processing device **10** may include a threshold change unit **62**.

The threshold change unit **62** decreases the threshold, based on a distance between a user's first designated position and second designated position, the distance being determined in the past by the collision determination unit **58** as being equal to or smaller than a threshold while the first designated position and second designated position are detected by a detection unit.

For example, the threshold change unit **62** stores in the storage unit **50** (the auxiliary storage unit **13**) history data on history of the above described distance determined by the collision determination unit **58** in the past as being equal to or smaller than a threshold. FIG. **14** shows one example of the history data. For example, when the collision determination unit **58** determines that the above-described distance is equal to or smaller than a threshold, the threshold change unit **62** additionally registers the distance to the history data shown in FIG. **14**.

For example, the threshold change unit **62** calculates the average of the distances registered as the history data. Further, the threshold change unit **62** calculates the difference (Δd) between the average and the threshold, and decreases the threshold in accordance with the difference (Δd). In this case, the threshold change unit **62** decreases the threshold in a range not falling short of the average.

Specifically, for example, the threshold change unit **62** determines whether or not the above-described difference (Δd) is equal to or larger than a predetermined reference value. Then, when the above-described difference (Δd) is equal to or larger than the predetermined reference value, the threshold change unit **62** changes the threshold (D), using the expression (1) below, in which "k" in the expression (1) is a coefficient set to a value larger than 0 but smaller than 1 (for example, 0.7)

$$D=D-\Delta d*k \tag{1}$$

Note that the threshold change unit **62** may change the threshold (D) according to the above described expression (1), irrespective of whether the above-described difference (Δd) is equal to or larger than a predetermined reference value.

With a smaller threshold for the collision determination unit **58**, it is less likely determined that objects have collided despite lack of a user's intension of colliding the objects (product images **22**). That is, with a smaller threshold for the collision determination unit **58**, it is possible to improve accuracy in determining whether or not a user has collided objects displayed in a screen.

In this regard, according to the above described threshold change unit **62**, it is possible to decrease the threshold with respect to a user who tends to move two fingers pointing out objects so as to get very close to each other when making the objects contact each other (that is, a user who tends to leave the distance between the two designated positions very small when making the objects contact each other). Consequently, it is possible to improve accuracy in determining whether or not a user has collided objects displayed in a screen.

Second Embodiment

An information processing device according to a second embodiment of the present invention will be described. An information processing device **10** according to the second embodiment has a similar hardware structure as that of the information processing device **10** according to the first embodiment (see FIG. **1**).

According to the information processing device **10** in the second embodiment, an authentication screen, such as is shown in FIG. **15**, for example, is displayed upon turning on the power, releasing screen lock, retrieving from the sleep mode, or the like. This authentication screen is displayed

instead of a general authentication screen, such as one for receiving four-digit number input as a password, for example.

In the authentication screen shown in FIG. **15**, a plurality of objects **80**A to **80**F is displayed. Initial display positions of objects **80**A to **80**F are determined at random. Further, different display manners are set to the respective objects **80**A to **80**F so that a user can distinguish the objects **80**A to **80**F. That is, in the example shown in FIG. **15**, different letters are given to the respective objects **80**A to **80**F. Note that display manners of the objects **80**A to **80**F may be set to any manner as long as the manner allows a user to distinguish the respective objects **80**A to **80**F. For example, different symbols or numbers may be given to the respective objects **80**A to **80**F; the respective objects **80**A to **80**F may be displayed in different colors or shapes; or different images may be used for the respective objects **80**A to **80**F. Note that the objects **80**A to **80**F may be hereinafter collectively referred to as the object **80**.

In the following, an arrangement for implementing user authentication in an authentication screen shown in FIG. **15** will be described. According to the information processing device **10** in the second embodiment, a user designates in advance two objects among the objects **80**A to **80**F displayed in the authentication screen. That is, the user designates in advance a first object **80** and a second object **80** among the objects **80**A to **80**F. The user also designates in advance collision manners (how to collide) of these objects **80**. For example, a user designates in advance a positional relationship between these objects **80** in collision. Specifically, a user designates in advance the direction from the first object **80** to the second object **80** (a direction in the screen coordinate system).

Information indicating a combination of objects **80** designated in advance by a user (hereinafter referred to as "reference combination information") and vector information indicating the above described direction designated in advance by the user (hereinafter referred to as "reference direction information") is stored encrypted in the auxiliary storage unit **13**. FIG. **16** shows one example of the reference combination information and the reference direction information stored in the auxiliary storage unit **13**. In the example shown in FIG. **16**, the object **80**C given the letter "C" is designated as the first object **80**, while the object **80**F given the letter "F" is designated as the second object. The reference combination information and the reference direction information stored in the auxiliary storage unit **13** are used as information for executing user authentication. That is, these information items are used as information having the same function as that of a general user ID and a general password.

In a case in which reference combination information and reference direction information, such as are shown in FIG. **16**, are stored, a user collides the object **80**C given the letter "C" against the object **80**F given the letter "F" in the authentication screen shown in FIG. **15**. In the above, simple collision between these objects **80**C and **80**F is not sufficient, and the user is required to collide the objects **80**C and **80**F such that the direction from the object **80**C, designated as the first object **80**, to the object **80**F, designated as the second object **80**, substantially coincides with the direction indicated by the reference direction information. When the objects **80**C and **80**F collide such that the direction from the object **80**C to the object **80**F substantially coincides with the direction indicated by the reference direction information, the user is judged authentic, upon which user authentication is duly completed.

The above described authentication screen can provide higher security, compared to an authentication screen or the like for receiving a four-digit number input as a password. Further, according to the above described authentication screen, an operation required of a user to perform user authentication is a relatively simple operation of colliding two predetermined objects **80** in a predetermined direction, and no complicated operation (input) is required of a user. That is, according to the above described authentication screen, it is possible to improve security while ensuring not to require a user to perform a complicated operation (input).

In the following, a structure for implementing the above described authentication screen will be described. The information processing device **10** in the second embodiment has functional blocks similar to those of the information processing device **10** in the first embodiment (see FIG. **6** or **13**). In the following, a difference from the first embodiment as to the respective functional blocks in the second embodiment will be mainly described.

The storage unit **50** stores the display positions of the objects **80**A to **80**F displayed in the authentication screen. Further, the storage unit **50** (reference information storage means) stores the reference combination information and the reference manner information. The "reference combination information" is information indicating a combination of two objects **80** designated in advance by a user among a plurality of objects **80**A to **80**F. The "reference manner information" is information on a manner designated by a user as a collision manner (how to collide) of these two objects **80**. For example, the "reference manner information" includes information on a positional relationship between the above described two objects **80** in collision. For example, the reference combination information and the reference direction information, such as are shown in FIG. **16**, are stored in the storage unit **50**.

The display control unit **52** displays an authentication screen, such as is shown in FIG. **15**, for example, on the display unit **15**.

When the collision determination unit **58** determines that two objects **80** among the objects **80**A to **80**F displayed in the authentication screen have collided, the processing executing unit **60** executes processing relevant to these two objects **80**, based on the collision manner of these two objects **80**.

For example, when the collision determination unit **58** determines that two objects **80** among the objects **80**A to **80**F displayed in the authentication screen have collided, the processing executing unit **60** (combination determination unit) determines whether or not the combination of these two objects **80** coincides with the combination indicated by the reference combination information. Further, the processing executing unit **60** (manner comparing means) compares the collision manner of these two objects **80** and that indicated by the reference manner information. Then, the processing executing unit **60** (authentication processing executing means) executes authentication processing, based on the result of determination as to whether or not the above-described combination coincides with the combination indicated by the reference combination information and the result of comparison between the above described collision manner and the collision manner indicated by the reference manner information. Details on the processing executing unit **60** will be described later (see FIG. **17**).

In the following, processing that is executed by the information processing device **10** while the authentication screen is displayed will be described. The processing executed in the information processing device **10** with the

authentication screen displayed is similar to the processing shown in FIG. **12**. That is, processing similar to that shown in FIG. **12** is repetitively executed for every predetermined period of time (for example, $1/60^{th}$ of a second) while the authentication screen is displayed. Therefore, processing executed in the information processing device **10** with the authentication screen displayed will be described with reference to FIG. **12**. Note that processing for moving the objects **80**A to **80**F in accordance with change of a user's designated position is also executed while the authentication screen is displayed, though not described here.

When the authentication screen is displayed, the control unit **11** (detection result obtaining unit **54**) obtains the number (N) of a user's designated positions detected by the detection unit (touch panel) (S**101**). Then, the control unit **11** determines whether or not the number (N) is two or larger (S**102**). When the above-described number (N) is two or larger, the control unit **11** initializes the value of the variable i to one (S**103**). Then, the control unit **11** determines whether or not the i^{th} designated position is included in any determination area (S**104**). Note that the "determination area" is an area that is set based on the display position of the object **80** and is set for determining whether or not a user is pointing out the object **80**.

When the i^{th} designated position is included in any determination area, the control unit **11** initializes the value of the variable j to i+1 (S**105**), and then determines whether or not the j^{th} designated position is included in another determination area (S**106**). When the j^{th} designated position is included in another determination area, the control unit **11** obtains the distance (d) between the i^{th} designated position and the j^{th} designated position (S**107**). Then, the control unit **11** (collision determination unit **58**) determines whether or not the distance (d) is equal to or smaller than the threshold (D) (S**108**).

Note that processing that is executed when it is not determined at step S**104** that the i^{th} designated position is included in any determination area is similar to that in the first embodiment. Further, processing that is executed when it is not determined at step S**106** that the i^{th} designated position is included in another determination area or when it is not determined at step S**108** that the above-described distance (d) is equal to or smaller than the threshold (D) is also similar to that in the first embodiment.

When it is determined at step S**108** that the above-described distance (d) is equal to or smaller than the threshold (D), the control unit **11** determines that the objects **80** have collided. In this case, the control unit **11** (processing executing unit **60**) executes the processing shown in FIG. **17**, instead of the processing at step S**109**.

That is, the control unit **11** (combination determination unit) determines whether or not the combination of the objects **80** in collision coincides with the combination indicated by the reference combination information (S**201**). For example, when the reference combination information shown in FIG. **16** is stored, the control unit **11** determines whether or not one of the objects **80** in collision is the object **80**C given the letter "C" designated in advance as the first object **80**, and then determines whether or not the other of the objects **80** in collision is the object **80**F given the letter "F" designated in advance as the second object **80**.

When the combination of the objects **80** in collision coincides with the combination indicated by the reference combination information, the control unit **11** obtains the direction from the first object **80** to the second object **80** (S**202**). For example, when the reference combination information shown in FIG. **16** is stored, the control unit **11** obtains the direction from the object **80**C given the letter "C" to the object **80**F given the letter "F". Specifically, as shown in FIG. **18**, the control unit **11** obtains the direction **90** from the representative position **82**C (for example, the center point) of the object **80**C to the representative position **82**F (for example, the center point) of the object **80**F.

After execution of step S**202**, the control unit **11** (direction determination means) obtains the angle (θ) between the direction obtained at step S**202** and the direction indicated by the reference direction information (S**203**). For example, when the reference combination information shown in FIG. **16** is stored, the control unit **11** obtains the angle (θ) between the direction **90** from the object **80**C given the letter "C" to the representative position **82**F of the object **80**F given the letter "F" and the direction **92** indicated by the reference direction information, as shown in FIG. **18**.

After execution of step S**203**, the control unit **11** (direction determination means) determines whether or not the angle (θ) obtained at step S**203** is equal to or smaller than the reference angle (θc) (S**204**). When it is determined that the above-described angle (θ) is equal to or smaller than the reference angle (θc), the control unit **11** determines that the direction obtained at step S**202** substantially coincides with the direction indicated by the reference direction information. In this case, the control unit **11** (authentication processing executing means) judges the user authentic, and allows the user to use the information processing device **10** (S**205**). For example, the control unit **11** displays the menu screen on the display unit **15**.

Meanwhile, when it is not determined that the above-described angle (θ) is equal to or smaller than the reference angle (θc), the control unit **11** (authentication processing executing means) judges the user not authentic, and displays an error message (S**206**). Note that when it is not determined at S**201** that the combination of the objects **80** in collision coincides with the combination indicated by the reference combination information, the control unit **11** (authentication processing executing means) judges the user not authentic, and displays an error message (S**206**). In these cases, the control unit **11** does not allow the user to use the information processing device **10**. Description on the processing that is executed while the authentication screen is displayed is completed with the above.

According to the above described information processing device **10** in the second embodiment, it is possible to increase security while ensuring not to require a user to perform a complicated operation (input).

Note here that, for example, when the reference combination information shown in FIG. **16** is stored, a user needs to collide the objects **80**C and **80**F such that the direction from the object **80**C given the letter "C" to the object **80**F given the letters "F" substantially coincides with the direction indicated by the reference direction information, as described above. In this case, before colliding the objects **80**C and **80**F, a user moves at least one of the objects **80**C and **80**F to change the positional relationship between the objects **80**C and **80**F into one that allows collision between the objects **80**C and **80**F such that the direction from the object **80**C to the object **80**F substantially coincides with the direction indicated by the reference direction information.

However, for example, when the screen is small in the size or when a relative larger number of objects **80** in view of the size of the screen are displayed in the screen, the objects **80** likely contact each other or are placed one on the other. Therefore, it is probable that objects **80**C and **80**F contact each other or placed one on the other in the process of changing the positional relationship between the objects **80**C

and **80**F. In such a case, according to a conventional determination method, it is determined that the objects **80**C and **80**F have collided against each other, and authentication processing is thus executed based on the direction from the object **80**C to the object **80**F.

On the contrary, according to the information processing device **10** in the second embodiment, similar to the first embodiment, whether or not the objects **80** have collided is determined, based on a user's two designated positions. As a result, it is possible to avoid determining that objects **80** have collided in the process performed by a user to adjust the positional relationship between the objects **80**.

Note that the second embodiment may be arranged as described below.

[1] At step S**202** in FIG. **17**, the direction from a designated position that is determined as being included in the determination area of the first object **80** to another designated position that is determined as being included in the determination area of the second object **80** may be obtained, instead of the direction from the representative position (for example, the center point) of the first object **80** to the representative position (for example, the center point) of the second object **80**. Alternatively, the direction from the representative position (for example, the center point) of the first object **80** to a designated position that is determined as being included in the determination area of the second object **80** may be obtained. Still alternatively, the direction from a designated position that is determined as being included in the determination area of the first object **80** to the representative position (for example, the center point) of the second object may be obtained.

[2] According to the above described authentication method, when a user has made two objects **80** designated in advance as the first object **80** and the second object **80** contact each other such that the direction from the first object **80** to the second object **80** substantially coincides with the direction indicated by the reference direction information, the user is judged authentic. Alternatively, a user may be judged authentic when the user has made two objects **80** designated in advance by the user contact each other such that the direction from one of the two objects **80** to the other substantially coincides with the direction indicated by the reference direction information.

When the reference combination information and reference direction information shown in FIG. **16**, for example, are stored, the user may be judged authentic not only when the user has made two objects **80**C and **80**F contact each other such that the direction from the object **80**C given the letter "C" to the object **80**F given the letter "F" substantially coincides with the direction indicated by the reference direction information, but also when the user has made two objects **80**C and **80**F contact each other such that the direction from the object **80**F given the letter "F" to the object **80**C given the letter "C" substantially coincides with the direction indicated by the reference direction information as well.

[3] According to the above described authentication method, a user designates in advance a combination of two objects **80** and the direction from the first object **80** to the second object **80**. Alternatively, instead of designating in advance the above-described direction, a user may designate in advance the relative speed of the first object **80** relative to the second object **80**.

In this case, information indicating a combination of the objects **80** designated in advance by a user (hereinafter referred to as "reference combination information") and information indicating the above described relative speed designated in advance by the user (hereinafter referred to as "reference relative speed information") are stored encrypted in the auxiliary storage unit **13**. FIG. **19** shows one example of the reference combination information and reference relative speed information stored in the auxiliary storage unit **13**. In the example shown in FIG. **19**, "v" indicates a speed designated as a relative speed of the first object **80** (the object **80**C given the letter "C") relative to the second object **80** (the object **80**F given the letter "F").

When the reference combination information and reference relative speed information, such as are shown in FIG. **19**, are stored, a user collides the object **80**C given the letter "C" against the object **80**F given the letter "F" in the authentication screen shown in FIG. **15**. In the above, it is not sufficient to simply collide these objects **80**C and **80**F, but the user needs to collide the objects **80**C and **80**F such that the relative speed of the object **80**C relative to the object **80**F substantially coincides with the relative speed indicated by the reference relative speed information. When the objects **80**C and **80**F collide such that the relative speed of the object **80**C relative to the object **80**F substantially coincides with the relative speed indicated by the reference relative speed information, the user is judged authentic, upon which user authentication is duly terminated.

In this case, at step S**202** in FIG. **17**, the control unit **11** obtains the respective speeds of the objects **80** in collision, and then obtains the relative speed of the object **80** designated as the first object **80** relative to the object **80** designated as the second object **80**. For example, when the reference combination information shown in FIG. **19** is stored, the respective speeds of the object **80**C given the letter "C" and the object **80**F given the letter "F" in collision are obtained, and the relative speed of the object **80**C relative to the object **80**F is obtained. Then, at step S**203**, the control unit **11** (relative speed determination means) obtains the speed difference between the relative speed obtained at step S**202** and the relative speed indicated by the reference relative speed information. Further, at step S**204**, the control unit **11** (relative speed determination means) determines whether or not the speed difference is equal to or smaller than a reference difference. When it is determined that the above-described speed difference is equal to or smaller than the reference difference, the control unit **11** (authentication processing executing means) judges the user authentic, and allows the user to use the information processing device **10**.

Note that, at step S**202**, instead of obtaining the speed of the object **80**, the control unit **11** may obtain the speed of a designated position determined as being included in the determination area of the object **80**. Then, the control unit **11** may obtain the relative speed of a designated position determined as being included in the determination area of the first object **80** relative to a designated position determined as being included in the determination area of the second object **80**. Note that the control unit **11** may obtain the relative speed of the first object **80** relative to a designated position determined as being included in the determination area of the second object **80** or the relative speed of a designated position determined as being included in the determination area of the first object **80** relative to the second object **80**.

According to the above described authentication method, when a user has made two objects **80** designated in advance as the first and second objects **80** contact each other such that the relative speed of the first object **80** relative to the second object **80** substantially coincides with the relative speed indicated by the reference relative speed information, the user is judged authentic. However, a user may be judged

authentic when the user has made two objects **80** designated in advance by the user contact each other such that the relative speed of one of the two objects **80** relative to the other substantially coincides with the relative speed indicated by the reference relative speed information.

For example, when reference combination information and reference relative speed information shown in FIG. **19** is stored, a user may be judged authentic not only when the user has made two objects **80**C and **80**F contact each other such that the relative speed of the object **80**C relative to the object **80**F substantially coincides with the relative speed indicated by the reference relative speed information but also when the user has made two objects **80**C and **80**F contact each other such that the relative speed of the object **80**F relative to the object **80**C substantially coincides with the relative speed indicated by the reference relative speed information.

[4] Note that both of the above-described reference direction information and reference relative speed information may be stored together with the reference combination information in the auxiliary storage unit **13**. That is, a combination of two objects **80**, the direction from the first object **80** to the second object **80**, and the relative speed of the first object **80** relative to the second object **80** may be designated by a user in advance, and authentication processing may be executed based on these.

For example, when the reference combination information shown in FIGS. **16** and **19**, the reference direction information shown in FIG. **16**, and the reference relative speed information shown in FIG. **19** are stored, if a user has collided the objects **80**C and **80**F such that the direction from the object **80**C to the object **80**F substantially coincides with the direction indicated by the reference direction information and the relative speed of the object **80**C relative to the object **80**F substantially coincides with the relative speed indicated by the reference relative speed information, the user may be judged authentic.

[5] In the second embodiment as well, similar to the first embodiment, the collision determination unit **58** may determine whether or not "a state in which a user's first designated position is included in the determination area of one object **80**, the user's second designated position is included in the determination area of another object **80**, and the distance (d) between the first designated position and the second designated position is equal to or smaller than a threshold" lasts for a reference period of time. In other words, when the object moving unit **56** moves one object **80** and another object **80**, the collision determination unit **58** may determine whether or not "a state in which the distance (d) between the first designated position and the second designated position is equal to or smaller than a threshold" lasts for a reference period of time. Then, when the above-described state lasts for a reference period of time, the control unit **11** may determine that the one object **80** has collided against the other object **80**.

With the above, when the above described distance (d) has temporarily become equal to or smaller than a threshold despite lack of an intention of colliding two objects **30**, it is not determined that these two objects have collided. In this manner, it is possible to further improve the accuracy in determining whether or not a user has collided the objects **80** displayed in the authentication screen.

Note that the present invention is not limited to the above described first and second embodiments.

[1] For example, the above described collision determining method can be used with various screens.

For example, in determining whether or not a user has collided icons in a screen where a plurality of icons each correlated to a file or a folder (directory) are displayed, the above described collision determining method can be used.

When a user has collided icons in this screen, the files (folders) correlated to the two respective icons may be unified. Alternatively, a difference between the files (folders) correlated to the two respective icons may be displayed. Alternatively, a file (folder) correlated to one icon may be overwritten by a file (folder) correlated to the other icon. Still alternatively, the files (folders) correlated to the two respective icons may be erased.

Note that the processing executing unit **60** may change the content of processing relevant to the icons in collision, based on the collision manner of the icons. For example, the processing executing unit **60** may selectively execute any of the above described processing, based on the collision manner of the icons. In this case, data for correlating information describing a collision manner of icons and information describing the content of processing relevant to icons in collision (for example, information indicating any of the above described processing) may be stored in the storage unit **50**. Then, based on the data, the processing executing unit **60** may execute processing correlated to the collision manner of the icons as processing relevant to the icons in collision.

Note here that, for example, "information describing a collision manner of icons" refers to information indicating a positional relationship between two icons in collision, being specifically information indicating the direction from one of the two icons in collision to the other. With the above, it is possible to change the content of processing relevant to these two icons, based on the direction from one of the two icons in collision to the other.

Further, for example, "information describing a collision manner of icons" refers to information indicating a speed relationship between two icons in collision, being specially information indicating the relative speed of one of the two icons in collision relative to the other. With the above, the content of processing relevant to the two icons can be changed, based on the relative speed of one of the two icons in collision relative to the other.

When image data is correlated to an icon, image data resulting from combination of image data items correlated to two respective icons in collision may be displayed.

Further, the above described collision determining method can be used in determining whether or not a user has collided game characters in a game screen where a plurality of game characters are displayed, for example.

That is, when a user collides game characters in the game screen, a comparison screen for comparing parameter information items (attribute information) of these game characters may be displayed. Alternatively, the game characters may communicate with each other. Further alternatively, these game characters may fight. Note that the processing executing unit **60** may change the content of processing relevant to the game characters in collision, based on the collision manner of the game characters. For example, the processing executing unit **60** may selectively execute any of the above described processing, based on the collision manner of the game characters.

In a case in which game characters are caused to fight against each other when a user collides the game characters, the parameter information items (attribute information) of these game characters may be compared to each other to determine a winner and a lower. Then, a winner game character may be left in game screen, while a loser game

character may disappear from the game screen. Note that the loser game character may move to an end of the game screen.

Further, the above described collision determining method can be used with a recipe search screen, for example, where an icon correlated to a raw material (material) is displayed.

That is, when a user has collided icons in the recipe search screen, a menu which can be made using the materials correlated to these icons is searched for, and a recipe of the menu is displayed. The above described collision determining method can be used also in determining whether or not a user has collided icons in such a recipe search screen.

[2] It is described in the above that two objects are movable when being pointed out by a user with his/her two fingers. That is, one object moves in accordance with movement of one finger, and the other object moves in accordance with movement of the other finger.

However, only one of the two objects pointed out by a user with his/her two fingers may be movable. In this case, for example, only the object first pointed out by the user may be movable, or only the object second pointed out by the user may be movable.

Here, assume a case of an example shown in FIGS. **4**, **10**, and **11**, for example. Further, assume a case in which only the product image **22** first pointed out by a user is movable. In this case, supposing that the user points out the product image **22**C prior to the product image **22**B, the user can move only the product image **22**C. In this case, the user moves the finger pointing out the product image **22**C toward the finger pointing out the product image **22**B, whereby the product image **22**C is made colliding against the product image **22**B.

[3] For example, the screen displayed on the display unit **15** may be generated using a 3D computer graphics technique. For example, a screen showing a picture of a 3D space where a plurality of objects is placed viewed from a virtual camera may be displayed on the display unit **15**.

[4] For example, the designation unit (operating unit **14**) for use by a user to designate a position in a screen displayed on the display unit **15** may not be provided overlapping the display unit **15**, but apart from the display unit **15**.

The invention claimed is:

1. An information processing device, comprising:

at least one non-transitory memory operable to store program code; and

at least one processor operable to read said program code and operate as instructed by said program code, said program code causing said at least one processor to:

display a screen including a plurality of objects on a display;

obtain a result of detecting a plurality of a user's designated positions in the screen;

in a case where one of the user's designated position is detected and the one designated position is included in a determination area that is set based on a position of one object among the plurality of objects, move the one object in accordance with movement of the one designated position;

in a case where at least one of a first object and a second object is moved, determine whether or not the first object and the second object collide with each other in a state that the user's first designated position by a first finger is included in a determination area set based on a position of the first object and the user's second designated position by a second finger is included in a determination area set based on a position of the second object; and

execute processing relevant to the first object and the second object, based on a result of the collision determination,

wherein in a case where the user's first designated position is included in the determination area set based on the position of the first object, the user's second designated position is included in the determination area set based on the position of the second object, the at least one of the first object and the second object is moved, and the distance between the first designated position and the second designated position is equal to or smaller than a threshold, it is determined that the first object and the second object collide with each other, whereas in a case where the distance is larger than the threshold, even if the first object and the second object contact or overlap with each other, it is determined that the first object and the second object does not collide with each other.

2. The information processing device according to claim **1**, wherein in a case where the first object and the second object are moved, and a state in which the distance between the first designated position and the second designated position is equal to or smaller than the threshold lasts for a predetermined period of time, it is determined that the first object and the second object collide with each other.

3. The information processing device according to claim **1**,

wherein the threshold is dynamically changed based on a distance between a previous first designated position and a previous second designated position when it was determined that the first object and the second object collided with each other.

4. The information processing device according to claim **1**, wherein in a case where it is determined that the first object and the second object collide with each other, the processing relevant to the first object and the second object is executed based on a collision manner of the first object and the second object.

5. The information processing device according to claim **4**, wherein in the case where it is determined that the first object collides against the second object, any of a plurality of kinds of processing relevant to the first object and the second object is selected based on the collision manner of the first object and the second object, and then executes the selected processing.

6. The information processing device according to claim **4**, further comprising a reference information storage that stores reference combination information indicating a combination of two objects among the plurality of objects designated in advance by the user, and reference manner information indicating a manner designated in advance by the user as the collision manner of the two objects,

wherein said program code causes said at least one processor to:

display the plurality of objects in mutually different display manners in the screen,

determine whether or not a combination of the first object and the second object is identical to the combination indicated by the reference combination information in the case where it is determined that the first object and the second object collide with each other,

compare a collision manner of the first object and the second object and the manner indicated by the refer-

ence manner information in the case where it is determined that the first object and the second object collide with each other, and

execute authentication processing based on a result of determination of whether or not the combination of the first object and the second object is identical to the combination indicated by the reference combination information, and a result of comparison of the collision manner of the first object and the second object and the manner indicated by the reference manner information.

7. The information processing device according to claim **6**, wherein

the reference manner information includes reference direction information indicating a direction designated in advance by the user,

said program code causes said at least one processor to:

determine whether or not an angle between a direction from one to another of the first object or the first designated position and the second object or the second designated position and the direction indicated by the reference direction information is equal to or smaller than a reference angle, and

execute the authentication processing based on the result of determination of whether or not the combination of the first object and the second object is identical to the combination indicated by the reference combination information, and a result of determination of the angle is equal to or smaller than the reference angle.

8. The information processing device according to claim **6**, wherein

the reference manner information includes reference relative speed information indicating a relative speed designated in advance by the user,

said program code causes said at least one process to:

determine whether or not a speed difference between a relative speed of one relative to another of the first object or the first designated position and the second object or the second designated position and the relative speed indicated by the reference relative speed information is equal to or smaller than a reference difference, and

execute the authentication processing based on the result of determination of whether or not the combination of the first object and the second object is identical to the combination indicated by the reference combination information, and a result of determination of whether or not the speed difference is equal to or smaller than the reference difference.

9. The information processing device of claim **1**, wherein

said program code further causes said at least one processor to:

in a case where the user's first designated position is included in the determination area that is set based on the position of the first object, move the first object in accordance with movement of the user's first designated position;

in a case where the user's second designated position is included in the determination area that is set based on the position of the second object, move the second object in accordance with movement of the user's second designated position; and

in a case where both the first object and the second object are moved, determine whether or not the first object and the second object collide with each other in a state that the user's first designated position is included in the determination area set based on the position of the first object and the user's second designated position is included in the determination area set based on the position of the second object.

10. An information processing device, comprising:

at least one non-transitory memory operable to store program code; and

at least one processor operable to read said program code and operate as instructed by said program code, said program code causing said at least one processor to:

display a screen including a plurality of objects on a display;

obtain a result of a plurality of a user's designated positions in the screen;

in a case where one of the user's designated positions is detected and the one designated position is included in a determination area that is set based on a position of one object among the plurality of objects, move the one object in accordance with movement of the one designated position;

in a case where at least one of a first object and a second object is moved determine whether or not the first object and the second object collide with each other; and

execute processing relevant to the first object and the second object based on a result of the collision determination;

wherein

said program code causes said at least one processor to:

obtain at least a part of content stored in a reference information storage that stores reference combination information indicating a combination of two objects among the plurality of objects designated in advance by the user, and reference manner information indicating a manner designated in advance by the user as the collision manner of the two objects,

display the plurality of objects in mutually different display manners in the screen,

determine whether or not a combination of the first object and the second object is identical to the combination indicated by the reference combination information in a case where it is determined that the first object and the second object collide with each other,

compare a collision manner of the first object and the second object and the manner indicated by the reference manner information in the case where it is determined that the first object and the second object collide with each other, and

execute authentication processing based on a result of determination of whether or not the combination of the first object and the second object is identical to the combination indicated by the reference combination information, and a result of comparison of the collision manner of the first object and the second object and the manner indicated by the reference manner information,

wherein

the reference manner information includes reference direction information indicating a direction designated in advance by the user,

said program code causes said at least one processor to:

compare the collision manner of the first object and the second object and the manner indicated by the reference manner information by determining whether or not an angle between a direction from one to another of the first object and the second object and the direction indicated by the reference direction information is equal to or smaller than a reference angle, and

execute the authentication processing based on the result of determination of whether or not the combination of

the first object and the second object is identical to the combination indicated by the reference combination information, and a result of determination of whether or not the angle is equal to or smaller than the reference angle.

11. An information processing device, comprising:

at least one non-transitory memory operable to store program code;

at least one processor operable to read said program code and operate as instructed by said program code, said program code causing said at least one processor to:

display a screen including a plurality of objects on a display;

obtain a result of detecting a plurality of a user's designated positions in the screen;

in a case where one of the user's designated positions is detected and the one designated position is included in a determination area that is set based on a position of one object among the plurality of objects, move the one object in accordance with movement of the one designated position;

in a case where at least one of a first object and a second object is moved determine whether or not the first object and the second object collide with each other; and

execute processing relevant to the first object and the second object based on a result of the collision determination; wherein

said program code causes said at least one processor to:

obtain at least a part of content stored in a reference information storage that stores reference combination information indicating a combination of two objects among the plurality of objects designated in advance by the user, and reference manner information indicating a manner designated in advance by the user as the collision manner of the two objects,

display the plurality of objects in mutually different display manners in the screen,

determine whether or not a combination of the first object and the second object is identical to the combination indicated by the reference combination information in a case where it is determined that the first object and the second object collide with each other,

compare a collision manner of the first object and the second object and the manner indicated by the reference manner information in the case where it is determined that the first object and the second object collide with each other, and

execute authentication processing based on a result of determination of whether or not the combination of the first object and the second object is identical to the combination indicated by the reference combination information and a result of comparison of the collision manner of the first object and the second object and the manner indicated by the reference manner information,

wherein

the reference manner information includes reference relative speed information indicating a relative speed designated in advance by the user,

said program code causes said at least one processor to:

compare the collision manner of the first object and the second object and the manner indicated by the reference manner information by determining whether or not a speed difference between a relative speed of one of the first object and the second object relative to another of the first object and the second object and the relative speed indicated by the reference relative speed information is equal to or smaller than a reference difference, and

execute the authentication processing based on the result of determination of whether or not the combination of the first object and the second object is identical to the combination indicated by the reference combination information, and a result of determination of whether or not the speed difference is equal to or smaller than the reference difference.

12. A control method for an information processing device, the control method comprising:

displaying a screen including a plurality of objects on a display;

obtaining a result of detecting a plurality of a user's designated positions in the screen;

in a case where one of the user's designated positions is detected and the one designated position is included in a determination area that is set based on a position of one object among the plurality of objects, moving the one object in accordance with movement of the one designated position;

in a case where at least one of a first object and a second object is moved, determining whether or not the first object and the second object collide with each other in a state that the user's first designated position by a first finger is included in a determination area set based on a position of the first object and the user's second designated position by a second finger is included in a determination area set based on a position of the second object; and

executing processing relevant to the first object and the second object, based on a result of the collision determination,

wherein in a case where the user's first designated position is included in the determination area set based on the position of the first object, the user's second designated position is included in the determination area set based on the position of the second object, the at least one of the first object and the second object is moved, and the distance between the first designated position and the second designated position is equal to or smaller than a threshold, it is determined that the first object and the second object collide with each other, whereas in a case where the distance is larger than the threshold, even if the first object and the second object contact or overlap with each other, it is determined that the first object and the second object does not collide with each other.

13. A non-transitory computer readable information storage medium storing program code for causing a computer to:

display a screen including a plurality of objects on a display;

obtain a result of detecting a plurality of a user's designated positions in the screen;

in a case where one of the user's designated positions is detected and the one designated position is included in a determination area that is set based on a position of one object among the plurality of objects, move the one object in accordance with movement of the one designated position;

in a case where at least one of a first object and a second object is moved determine, whether or not the first object collides against the second object in a state that the user's first designated position by a first finger is included in a determination area set based on a position

of the first object and the user's second designated position by a second finger is included in a determination area set based on a position of the second object; and

execute processing relevant to the first object and the second object, based on a result of the collision determination,

wherein in a case where the user's first designated position is included in the determination area set based on the position of the first object, the user's second designated position is included in the determination area set based on the position of the second object, the at least one of the first object and the second object is moved, and the distance between the first designated position and the second designated position is equal to or smaller than a threshold, it is determined that the first object and the second object collide with each other, whereas in a case where the distance is larger than the threshold, even if the first object and the second object contact or overlap with each other, it is determined that the first object and the second object does not collide with each other.

14. A control method for an information processing device, the control method comprising:

displaying a screen including a plurality of objects on a display;

obtaining a result of detecting a plurality of a user's designated positions in the screen;

in a case where one of the user's designated positions is detected and the one designated position is included in a determination area that is set based on a position of one object among the plurality of objects, moving the one object in accordance with movement of the one designated position;

in a case where at least one of a first object and a second object is moved, determining whether or not the first object and the second object collide with each other;

executing processing relevant to the first object and the second object based on a result of the collision determination; and

obtaining at least a part of content stored in a reference information storage that stores reference combination information indicating a combination of two objects among the plurality of objects designated in advance by the user, and reference manner information indicating a manner designated in advance by the user as the collision manner of the two objects,

wherein

the plurality of objects are displayed in mutually different display manners in the screen,

the executing comprises:

determining whether or not a combination of the first object and the second object is identical to the combination indicated by the reference combination information in a case where it is determined that the first object and the second object collide with each other,

comparing a collision manner of the first object and the second object and the manner indicated by the reference manner information in the case where it is determined that the first object and the second object collide with each other, and

executing authentication processing based on a result of determination of whether or not the combination of the first object and the second object is identical to the combination indicated by the reference combination information, and a result of comparison of the collision manner of the first object and the second object and the manner indicated by the reference manner information,

the reference manner information includes reference direction information indicating a direction designated in advance by the user,

the comparing comprises determining whether or not an angle between a direction from one to another of the first object and the second object and the direction indicated by the reference direction information is equal to or smaller than a reference angle, and

the authentication processing is executed based on the result of determination of whether or not the combination of the first object and the second object is identical to the combination indicated by the reference combination information, and a result of determination of whether or not the angle is equal to or smaller than the reference angle.

15. A non-transitory computer readable information storage medium storing program code for causing a computer to

display a screen including a plurality of objects on a display;

obtain a result of detecting a plurality of a user's designated positions in the screen;

in a case where one of the user's designated positions is detected and the one designated position is included in a determination area that is set based on a position of one object among the plurality of objects, move the one object in accordance with movement of the one designated position;

in a case where at least one of a first object and a second object is moved, determine whether or not the first object and the second object collide with each other; and

execute processing relevant to the first object and the second object based on a result of the collision determination;

wherein

said program code causes the computer to:

obtain at least a part of content stored in a reference information storage that stores reference combination information indicating a combination of two objects among the plurality of objects designated in advance by the user, and reference manner information indicating a manner designated in advance by the user as the collision manner of the two objects,

display the plurality of objects in mutually different display manners in the screen,

determine whether or not a combination of the first object and the second object is identical to the combination indicated by the reference combination information in a case where it is determined that the first object and the second object collide with each other,

compare a collision manner of the first object and the second object and the manner indicated by the reference manner information in the case where it is determined that the first object and the second object collide with each other, and

execute authentication processing, based on a result of determination of whether or not the combination of the first object and the second object is identical to the combination indicated by the reference combination information, and a result of comparison of the collision manner of the first object and the second object and the manner indicated by the reference manner information,

wherein

the reference manner information includes reference direction information indicating a direction designated in advance by the user,

said program code causes the computer to:

compare the collision manner of the first object and the second object and the manner indicated by the reference manner information by determining whether or not an angle between a direction from one to another of the first object and the second object and the direction indicated by the reference direction information is equal to or smaller than a reference angle, and

execute the authentication processing based on the result of determination of whether or not the combination of the first object and the second object is identical to the combination indicated by the reference combination information, and a result of determination of whether or not the angle is equal to or smaller than the reference angle.

16. A control method for an information processing device, the control method comprising:

displaying a screen including a plurality of objects on a display;

obtaining a result of detecting a plurality of a user's designated positions in the screen;

in a case where one of the user's designated positions is detected and the one designated position is included in a determination area that is set based on a position of one object among the plurality of objects, moving the one object in accordance with movement of the one designated position;

in a case where at least one of a first object and a second object is moved, determining whether or not the first object and the second object collide with each other; and

executing processing relevant to the first object and the second object, based on a result of the collision; and

obtaining at least a part of content stored in reference information storage that stores reference combination information indicating a combination of two objects among the plurality of objects designated in advance by the user, and reference manner information indicating a manner designated in advance by the user as the collision manner of the two objects,

wherein

the plurality of objects are displayed in mutually different display manners in the screen,

the executing comprises:

determining whether or not a combination of the first object and the second object is identical to the combination indicated by the reference combination information in a case where it is determined that the first object and the second object collide with each other,

comparing a collision manner of the first object and the second object and the manner indicated by the reference manner information in the case where it is determined that the first object and the second object collide with each other, and

executing authentication processing, based on a result of determination of whether or not the combination of the first object and the second object is identical to the combination indicated by the reference combination information, and a result of comparison of the collision manner of the first object and the second object and the manner indicated by the reference manner information,

the reference manner information includes reference relative speed information indicating a relative speed designated in advance by the user,

the comparing comprises determining whether or not a speed difference between a relative speed of one of the first object and the second object relative to another of the first object and the second object and the relative speed indicated by the reference relative speed information is equal to or smaller than a reference difference in the case where it is determined that the first object and the second object collide with each other, and

the authentication processing is executed based on the result of determination of whether or not the combination of the first object and the second object is identical to the combination indicated by the reference combination information, and a result of determination of whether or not the speed difference is equal to or smaller than the reference difference.

17. A non-transitory computer readable information storage medium storing program code for causing a computer to:

display a screen including a plurality of objects on a display;

obtain a result of detecting a plurality of a user's designated positions in the screen;

in a case where one of the user's designated positions is detected and the one designated position is included in a determination area that is set based on a position of one object among the plurality of objects, move the one object in accordance with movement of the one designated position;

in a case where at least one of a first object and a second object is moved determine whether or not the first object and the second object collide with each other; and

execute processing relevant to the first object and the second object, based on a result of the collision determination,

wherein

the program code causes the computer to:

obtain at least a part of content stored in a reference information storage that stores reference combination information indicating a combination of two objects among the plurality of objects designated in advance by the user, and reference manner information indicating a manner designated in advance by the user as the collision manner of the two objects,

display the plurality of objects in mutually different display manners in the screen,

determine whether or not a combination of the first object and the second object is identical to the combination indicated by the reference combination information in a case where it is determined that the first object and the second object collide with each other,

compare a collision manner of the first object and the second object and the manner indicated by the reference manner information in the case where it is determined that the first object and the second object collide with each other, and

execute authentication processing, based on a result of determination of whether or not the combination of the first object and the second object is identical to the combination indicated by the reference combination information, and a result of comparison of the collision manner of the first object and the second object and the manner indicated by the reference manner information,

wherein

the reference manner information includes reference relative speed information indicating a relative speed designated in advance by the user,

the program code causes the computer to:

compare the collision manner of the first object and the second object and the manner indicated by the reference manner information by determining whether or not a speed difference between a relative speed of one of the first object and the second object relative to another of the first object and the second object and the relative speed indicated by the reference relative speed information is equal to or smaller than a reference difference in the case where it is determined that the first object and the second object collide with each other, and

execute the authentication processing, based on the result of determination of whether or not the combination of the first object and the second object is identical to the combination indicated by the reference combination information, and a result of determination of whether or not the speed difference is equal to or smaller than the reference difference.

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